APPENDICES

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- Geology Appendix *
- Fisheries Appendix *
- Wildlife Appendix *

WATERSHED ANALYSIS TEAM

TEAM LEADER

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APPENDIX B

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APPENDIX C

INFORMATION MANAGEMENT/ANALYSIS

EXISTING DATA

A Paradox database is available that lists all existing data for this watershed. The database can be obtained from the WA team leader at the Mckenzie Ranger District. This data table is continually being appended to include new data, so a hard copy is not provided here.

GIS LAYERS:

A description of all available GIS layers will be appended to this document at a later date.

ANALYTICAL PROCESSES

AQUATIC / RIPARIAN HABITAT DOMAIN

Issue:

Management practices such as road building/maintenance, timber harvest, and slash treatments may have changed the frequency and spatial distribution of mass wasting and surface erosion. This can result in increased turbidity and filling of large pools with sediment.

a. What is the range of variability, temporally and spatially, of natural and management-induced disturbance regimes?

Table 1-1

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Tran Layer	Yes P007	Forest-wide Clipped to SUBWA	Annotate with Road Related Landslide Data Base (GEOTECH).	GIS - Paper
Geology Layer	Yes G001	State -wide Clipped to SUBWA	Annotate with local lithology and structure from USGS/DOGAMI/and thesis maps.	GIS - Paper
Stream Layer	Yes H006	Forest-wide Clipped to SUBWA		GIS
SRI Layer	Yes G002 G003	Forest-wide Clipped to SUBWA	Query critical soils - 25/33/35, 255/334-.	GIS - Paper
Vegis Layer	Yes V004	Forest-wide Clipped to SUBWA	Query for managed stands - landslides.	GIS
Topo Layer	Yes A007	Forest-wide Clipped to SUBWA	Query for areas <30% scope 30 - 50% 50 - 70% 07 - 70% Query for Elevations 2000 - 2400' 2800 - 3200'	GIS - Paper
Fire History	Yes A003 A006 A009 A011 F101 V035	District	From District H.J. Andrews records, State Climatologist.	Paper

Table 1-1 (continued)

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Landslide & Debris Flow History	No/Yes	G004 G005 G007 G015	Air photo interpretation bracketed for 39, 53, 59, 67, 79, & 90 photos.	Paper
Precipitation Data	Yes	State-wide	NOAA, District, H.J Andrews records.	D.B. Paper

Description of General Analytical Process:

- Determine if any relationship exists, delineated spatially and temporally, in mass wasting (landslide, debris flow, erosion). Frequency and magnitude between natural regimes (topography, geology, climate and fire) and management activities such as timber harvest, road construction, prescribed fire.

- Analyze historical air photos in time-bracketed sequence (39, 53, 59, 67, 79, 90) for disturbance history by SUB watershed. Locate landslides debris flows major erosion features and survival debris fans. Determine size and date of occurrence if possible. Determine sediment delivery volume.

b. What are the processes operating within the uplands and riparian areas? More specifically, what are the sediment delivery mechanisms and relative rates to streams by landform or slope position?

Table 1-2

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
INFO on relationships between land form geology, fire history, harvest and sediment delivery answered in 1a.	Answer to be obtained in 1a.	Subwatershed		
Stream Habitat	F001			
Stream Channel	F004			

Description of General Analytical Process:

- Determine relative rates of regiment delivery due to geology, landform, fire frequency/intensity during pre-management period (1800's - 1900's?).
- From answers obtained in 1a, determine relative rates of sediment delivery due to environmental/physical factors (#1), plus rate changes due to fire suppression, harvest, and roads. Post-management relative delivery rates.
- Use stream surveys to locate slides, sediment sources and areas of severe aggradation or degradation.

PRODUCTS:

- Map of pre-management relative sediment delivery rates.
- Map of post-management relative sediment delivery rates.
- Narrative describing basic channel conditions including sediment size, relative amounts and changes in these parameters due to management. Stratified by geology/landform and potentially subwatersheds.

Issue:

Increases in peak flows resulting from timber harvest and extension of the drainage network by road systems may have reduced channel complexity through scouring and down cutting of the channel, isolating side channels, and transport of large woody debris out of the system. The overall effect may be a reduction in pool numbers and sizes, less diverse sediment distribution within the channel, and a more uniform water velocity distribution along the stream channel.

a. Where have management activities affected the magnitude and frequency of peak flows and have increased peak flows reduced channel complexity and modified aquatic habitats beyond the range of historic variability?

Table 1-3

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Plant series for mapping transient snow zone				
Aspect (DEM's)	A007			
Soil depth (SRI's)				
Road density by PSUB on decade basis	P012			
Answers from 2F	Streams which seem to have highly unstable banks			
PPT. intensity map	Yes NOAA			
Steam surveys	F003 F004			
Harvest history	V006			

Description of General Analytical Process:

1. Construct map showing potential areas contributing to ROS based on plant series (rain zone, ROS, snow zone), aspect and soil depth.
2. Calculate hydrologic recovery (aggregate recovery percentage, ARP) for current recovery by subwatershed. Calculate recovery for one or two previous periods of high harvest rates.
3. Compare recovery values by PSUB to those mid-point values outline in LMP.
4. Compare amount and location of harvest units to areas that are potentially high contributing areas to ROS. Where many harvest areas are located in high contributing areas and recovery values are low, peak flows are potentially increased.
5. Compare road densities and potentially high contributing areas to ROS. High densities in high contributing areas would indicate increased peak flows.
6. For streams where peak flows potentially higher from harvest (step 4) or from roads (step 5), look at stream surveys for bank stability and pool frequency parameters. Where bank stability poor (and not due to geologic material), on pool frequency poor and evidence of extensive scour, then increased flows probably modified aquatic habitat.
7. Calculate percent harvest and roaded by subwatershed and smaller drainages. For areas with less than 20% harvest, go to step 6.

PRODUCTS:

- Map of potential areas contributing to ROS categorized by high, medium, low. Table of ARP by subdrainage.
- Table of percent harvest and roaded by subwatershed and drainage.

Issue:

Harvest of riparian vegetation, establishment/maintenance of recreation sites, and roads within the active floodplains has likely resulted in altered processes and functions of the riparian ecosystem, reduced amounts of large woody debris, increased stream temperatures, and reduced channel complexity.

a. To what extent and to what degree has the riparian area and floodplain of Class I, II, III and IV streams been altered due to management? How has this alteration affected the aquatic ecosystem?

Table 1-4

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Harvest Units	V006 (Veg 4)			
Roads Layer	P007			
Stream Class Map	H006			
Aerial extent of recreation sites in riparian areas	No	Fullquad	Mapped from aerial photos.	
Designation of riparian area widths by valley segment type	No		Map valley segment types using topo maps and aerial photos. Assign riparian widths for each valley segment type.	

Description of General Analytical Process:

1. "Buffer" stream classes with riparian area widths.
2. Overlay roads and harvest units and recreation sites.
3. Determine area of riparian area that contains harvest units, roads, and recreation sites by stream class.

PRODUCTS:

- Table showing % of riparian by stream class impacted by harvest units, roads, and recreation sites.

b. Where is there a deficit of large wood in or adjacent to stream channels in the Upper Mckenzie sub-basin?

Table 1-5

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Stream surveys	F001 F003 F004			
Minear Thesis for Mainstem	F006			

Description of General Analytical Process:

1. Compare current levels of LWD determined from recent surveys to previous surveys.
2. Compare current levels of LWD from recent surveys to reference levels based on average bankful width and channel gradient.

PRODUCTS:

- Tables depicting current vs historical or reference amounts of LWD for mainstem and tributaries.

c. How has the quantity of in-stream wood changed over time in the Upper McKenzie River?

Table 1-6

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Definition of navigability	Navigability report, 1976. W&S Mgmt plan pg. 1&2			
Aerial photos				
Paula Minear Thesis	F006			

Description of General Analytical Process:

1. Talk to guides Dick Helfrich, Jim Goodpasture.
2. Through discussions with guides, documentation in Minear Thesis, and examination of aerial photos through time, document quantities and trend in wood input removal.
3. Determine ownership of wood in channel. Is it based on navigability? If so, is Upper McKenzie River deemed navigable?

d. What riparian areas are deficient in long term sources of wood?

Table 1-7

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Stream surveys or Valley segments	F003 F004 No		Valsegs to be manuscript on full quads and digitized.	
Veg size class	V006			
Insect and Disease	Yes			

Description of General Analytical Process:

1. Set up four categories of size classes from veg layer. Size class 1-3, 3.5-4.5, 5-5.5, more than 6.
2. Determine average height of site potential tree.
3. Buffer streams with width of site pot tree, and segment by reach breaks (from surveys) or valsegs.
4. Identify areas of good - excellent sources of streamside LWD, and areas of poor sources for several stream segments.
5. For each segment, determine what the size class is for pixel in buffer.
6. Calculate percentages of size classes for each segment deemed "good" sources and those deemed "poor" to determine criteria for assigning reaches as "low" and "high".
7. Assign those areas not categorized "low" and "high" to "moderate".
8. Overlay dead/disease/root rot areas to determine areas of potential high loading.
9. Grow stand through time (?).
10. Slope (?).

PRODUCT:

- Map showing stream network with large woody debris potential ratings of low, med, high.

e. Where have stream temperature and streambank instability exceeded the historic range of variability?

Table 1-8

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Stream Temp - Budworm	Yes (not on sheet) 1991-1994			
Stream Temp - REAP	A012			
Stream Temp - Deer Creek	Yes (not on sheet)			
Clipper Watershed report	1976-77, 1984, 1991-94			
Steam Temp -Mckenzie River	H015 H018			
Answers to 1b Natural & mgmt caused sediment del. mechanisms				
Stream surveys	F003 F004			
Minear Thesis	F006			

Description of General Analytical Process:

Temp:

1. Determine natural range of variability based on Budworm temps and work by D.Bates and RAP team.
2. Compare natural range to current McKenzie River temp data.
3. Use clipper watershed report that analyzed stream temp in Deer Creek.

Stability:

1. Use stream surveys to locate streams that seem to have high percentage of unstable banks.
2. Use info gained from 1b to determine if natural or management caused.
3. Use stream surveys and Minear thesis to determine if mainstem McKenzie has increased bank instability.

PRODUCTS:

- Narrative and potentially a graph of temps.
- Narrative and potentially a map showing reaches with increased bank instability.

Issue:

Highways 126, 242, 20 and 22 pass through the watershed, often through riparian areas. Both highways are managed and maintained by the Oregon Department of Transportation (ODOT). The management techniques used by ODOT may affect the condition of the riparian zone and the riparian vegetation.

a. In what ways have maintenance of these highways altered the riparian habitat, considering activities associated with surface maintenance, winter gravelling, use of de-icers, and roadside vegetative management?

Table 1-9

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
ODOT management practices	Yes	Highways	Check with engineering sources	

Description of general analytical process:

- Compare expected impacts of management practices with desired condition for riparian areas. Consider context and intensity of predicted impacts.

b. What management practices currently foster invasion and establishment of noxious weeds?

c. How affective are current management strategies to reduce the invasion and establishment of noxious weeds along travel corridors?

Table 1-10

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
ODOT's and District's current mgmt practices along travel corridors.	Yes	UPMA	From ODOT and District Engineer	Paper per com.
WNF Integrated Weed Management Plan	Yes	Forest Wide		Paper

Description of General Analytical Process:

- Describe ODOT's current practices along Hwy 126 and 242. Are these practices effective?

Issue:

The location of facilities, boat access points, and dispersed camp areas (within and outside of wilderness) may either be causing impacts or mitigating impacts of people using shorelines of rivers, lakes, and reservoirs.

a. What impacts are occurring and at which recreation areas?
b. Where are unacceptable impacts occurring?

Table 1-11

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Developed and Dispersed campgrounds on GIS	No	1" mile	Digitize from quads.	
Recreation use info.	Yes		RRIS reports	
ROS & WROS zones on GIS	NO	1" mile	Manuscript from hard copies and digitize	
Facility condition reports of developed Rec. sites	Yes		Hard copies	

Description of General Analytical Process:

- Inventory of dispersed and wilderness campsites, listing those that are within a "riparian setting" to be defined. Categorize by light, medium, heavy use. Show the distribution of sites in close proximity to each other. Get the standard used by the South Fore WA. See if we can quantify "scenic impacts" due to litter, vegetation loss in scenic areas. Inventory of ROS- use forest plan map of ROS, through GIS use capacity RVD/acre/year to see what we are offering vs. supposed demand by ROS. List the forest plant management areas, each is assigned a VQO, make a map of VQO then overlay GEGIS and WA boundary to give condition of landscape with harvest units. For developed recreation sites, list replacement needed items from facility condition report in RRIS. List seasonal facilities brought in to access launches as mitigation. List needed facilities (gray water sumps), age of existing septic systems.

Issue:

Potential impacts from point-source pollutants accidentally entering the water bodies from spills, leaks, draining hotspring, cleaning boats, rock sources, or from ODOT rock piles, may exist in the watershed. Non-point source pollutants such as nitrogen also have potential to enter streams within the watershed from forest fertilization activities.

a. What are some of the probable contaminants that could potentially enter, or are currently entering, the McKenzie River and what are their sources and effects on the aquatic ecosystem?

Table 1-12

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
List kinds of products trucked over pass Hwy 20 & 126	No		ODOT, HAZMAT teams, EWEB report.	
Info on hotsprings, boat cleaning at Clear Lake, rock sources, septic systems			Pat Hutchins, Kathy Keable, County - septic systems, EWEB GIS data layer.	
Forest fertilization records, application rates , where				
State applied herbicides				
DDT application				

Description of General Analytical Process:

1. Determine kinds of contaminants, where located, and rates of input or potential input.
2. Do literature search to determine effects on plants and animals in the water.

Issue:

Roads, dams, channelization, and slides may have isolated and fragmented components of the Upper McKenzie aquatic refugia system.

a. What is the historic and current distribution and abundance of trout, salmon and non-game fish in the Willamette basin?

b. Where and what elements have isolated and fragmented trout, salmon and non-game fish habitat.

c. What role does the Upper McKenzie sub-drainage play in providing refugia for aquatic organisms?

Table 1-13

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Level II surveys (OSU, USFS, ODFW) and REDD surveys	F001 F003			Oracle Paper
Salmon counts at Leaburg, Carmen, Tribs, EWEB/ODFW/ USFS	F003			Paper
Biological probes USFS/ODFW	F005			Paper
Basin reports ODFW/USFS	F007			Paper

Description of General Analytical Process:

1. Construct map of pre-dam fish distribution (game sp) and current distribution (include summary of barriers to migration). Determine: habitat loss due to construction of barriers/habitat degradation (% area lost)
2. Estimate historic range of abundance for game species and compare to current range of abundance.

PRODUCTS:

- Summary of aquatic inventory info available.
- Map of fish species distribution, historic and existing.
- Upper McKenzie's role in providing different organisms refugia.
- Identify data gaps (e.g. sculpin distribution.).

Issue:

The 3 dams within the Carmen-Smith Project may have had an impact upon the aquatic ecosystem within McKenzie and Smith Drainage's through the disruption of substrate and large woody debris transport, resulting in coarsened bedloads, downcutting and channelization below the dams. The hydrologic regime downstream of the dams may be affected by modifications in the timing and rates of streamflow and dewatering portions of the McKenzie River channel.

a. Have possible changes to the flow regime altered the timing of migration for historic juvenile or adult spring chinook?

Table 1-14

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
USGS gauging data Trail Bridge and Leaburg	H002 H003			
Salmon counts (upstream/down-stream migrants) at Leaburg/Carmen	F003			
State Basin reports	F007			
Dam project reports	F006			

Description of General Analytical Process:

1. Identify minimum allowable flow for spring Chinook migration [literature search may provide flow requirements].
2. To determine if peak flows have been dampened, compare frequency and magnitude of peak flows between pre- and post- Trail Bridge/Carmen/Smith dams. Examine previous migration to flows.

PRODUCTS:

- Identify potential conflict between flow alteration and spring chinook migration. If migration timing has been altered, determine flows necessary to restore historic migration in the Upper McKenzie.

b. To what extent have the dams modified the average flows during spring through late fall months, average daily maximum flow, and instantaneous peak flows? If the flows have been modified, how has it affected floodplain processes and function, their associated riparian area habitat, sediment transport and distribution, and aquatic habitat?

Table 1-15 FLOW ANALYSIS

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Discharge - Clear Lake	H020			
Discharge - McKenzie Bridge	H016			

Description of General Analytical Process:

Flow Analysis:

1. Do double mass plot of instantaneous peaks and annual max means for Clear Lake station and McKenzie Bridge station check for shift in line following 1963 (following completion of Carmen-Smith project).
2. Do double mass plot of minimum monthly flows for Clear Lake and McKenzie Bridge stations. Do 4 plots stratified by run off season: Oct-Dec, Jan- March, April - June, July - Sept. Check for shift in line following 1963.
3. Do T-test for average annual max mean flows, annual minimum mean flows, and annual instantaneous peaks. Use McKenzie Bridge station data. Two variables: 1. data prior to dam construction, 2. data following dam construction. Determine if significant difference in flows before and after dams.

Table 1-16 EFFECTS ANALYSIS

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Stream condition study COE/Sedell et al.. Masters Thesis Paula Minear	F006			Paper
USGS gauging data; Trailbridge	H002			Paper
Aerial Photos (Veg. Cond.)	A002			Photos
Side Channel area, LWD count	NO		Ground recon.	Map Paper

Description of General Analytical Process:
Effects Analysis:

- Much of this analysis complete in P. Minear thesis (riparian composition, channel condition,riparian development).
- Examine 1945 and later aerials and below dam channels. Measure side channel area between McKenzie Bridge and Trailbridge and verify on current aerials, if possible. Count in-stream LWD. Determine rearing area lost following dam construction.

PRODUCTS:

- A measure of side channel loss and quantities of in-stream wood.

Issue:

The stocking of non-native stocks (e.g., rainbow trout and brook trout) in the Upper McKenzie River may have influenced wild stocks through competition, hybridization or incidental catch mortality. Stocking of hatchery trout in the Upper McKenzie River and fishless wilderness lakes may have additional effects upon the terrestrial and aquatic ecosystem by concentrating recreational use and influencing predator/prey populations.

a. Where have non-native fish impacted wild stocks in the Upper McKenzie sub-basin?

b. What is the distribution and abundance of non-native aquatic species in the Upper McKenzie?

Table 1-17

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
ODFW stocking reports	F003			Paper
Biological Probes USFS; ODFW	F005			Paper
ODFW creel census	F003			Paper
Level II surveys (lakes and streams) Basin reports	F001 F007			Oracle Paper

Description of General Analytical Process:

1. Map ranges and estimated abundance of exotics.
2. Document areas of known conflict with indigenous stocks.
3. Document areas of naturalized species.
4. Determine: Sub-basin area occupied by exotics including lake area formerly fishless.
   - stream miles not occupied by exotics.
   - all lake area with past and present indigenous.
   - lake area with extirpated species.

PRODUCT:

- Overlay of various species to compare to distribution of indigenous species. Of particular interest are those in conflict (e.g. Brook trout/Bull trout, Brook trout/Cutthroat trout). This will answer : Where have conflicts occurred?

c. Where and how have terrestrial and aquatic components of the ecosystem been impacted by non-native fish stocking?

Table 1-18

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
ODFW stocking records streams/lakes	F003			Paper
Level II stream and lake surveys	F001			Paper
State Creel census	F003			Paper
Wilderness guard encounters/campsite condition surveys	?			?

Description of General Analytical Process:

- Use exotic species distribution to identify areas of fishing attraction. Determine from survey narratives the extent of terrestrial impact. Predator/prey impacts will rely on literature survey and species (of amphibians for example) likely to occur within a given area. Determine waters barren prior to stocking and now stocked by ODFW, compare lake survey water quality results for potential elevated enrichment.

PRODUCTS:

- Summary of terrestrial environs subject to fishing pressure with emphasis on overimpacted sites. A summary of the extent of terrestrial and aquatic alteration due to stocking.

d. How do current sportfishing regulations influence recreational use and wild fish stocks in the Upper McKenzie sub-basin?

Table 1-19

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
State Creel census	F003			Paper
Campsite use records	?			?
Wilderness guard encounters	?			?
Population estimates ODFW	?			?

Description of General Analytical Process:

- Narrative summary of state management objectives and methods to distribute stocked fish. Where stocked fish occur with native fish, describe potential conflicts. Summarize impacts to native populations through creel census, population estimates. Summarize current sportfishing regulations and where/ to what extent incidental take may occur.

PRODUCT:

- Overlay of campgrounds, river-access, stocking area/quantity to compare indigenous species distribution. Highlight high impact areas.

Issue:

Factors suppressing bull trout populations in the upper McKenzie River sub-basin are passage barriers, overharvest, hybridization/competition with brook trout and habitat degradation.

a. What factors increase the risk of bull tout population(s) extinction in the Upper McKenzie?

Table 1-20

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Population(s) estimates ODFW	F003			Paper
Level II surveys ODFW, USFS	F001			Paper

Description of General Analytical Process:

1. Describe habitat condition and population size.
2. Describe habitat connectivity within watershed.
3. Apply estimated population to Rieman/McIntyre model, to determine pop. viability/risk of extinction.

PRODUCT:

- Risk estimate, based upon population size, trends, suppressing factors and literature survey.

b. Are areas essential to bull trout life history requirements adequately protected from the effects of human disturbance?

Table 1-21

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Level II surveys ODFW, USFS	F001			
Stream temps	H001			
Aerial photo P. Minear study	A002 F006			
Biological probes Spanning surveys	F005 F003			

Description of General Analytical Process:

1. Range map comparison to habitat condition, including riparian condition (McKenzie mainstem, and spawning tributaries).
2. Examine: stream temps, riparian composition and age, in-stream wood, spawning and rearing habitat condition, prey composition.
3. Answer the question: Are riparian reserves adequate to protect bull trout habitat? (include historic range).

Issue:

Simplification of channels, habitat degradation and passage barriers may have resulted in loss of spring chinook spawning and rearing habitat in the Upper McKenzie River Subbasin.

a. Are areas essential to spring chinook life history requirements adequately protected from the effects of human disturbance?

Table 1-22

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Level II surveys and Redd surveys	F001 F003		Aerial and ground	
P. Minear study	F006			
Stream temps	H001			
Biological probes	F005			

Description of General Analytical Process:

1. Range map/habitat condition (including riparian condition).
2. Examine elements required for chinook production: water temps, in-stream wood, habitat condition, riparian composition. Identify habitat outside historic range of variability. Answer the question: Are riparian reserves adequate to protect chinook habitat?
3. Include hydro analysis - are peak flows beyond historic range?

b. Have utility mitigation efforts adequately supplemented loss of habitat since dam construction?

Table 1-23

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Redd surveys	F003			
Leaburg counts	F003			
Carmen counts/EWEB	F003			

Description of General Analytical Process:
1. Examine historical production.
2. Compare mitigation production to natural production.

a. What is the economic contribution of fisheries to the Upper McKenzie Subbasin?

Table 1-24

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
ODFW Creel census	F003			
Stocking reports ODFW	F003			
ODFW Salmon/steelhead tag returns	F003			

Description of General Analytical Process:
1. Determine effort/stocked fish and total spent/unit effort.
2. Determine effort/Chinook and average yearly catch.
3. Determine total spent/unit effort.

Issue:
Existing riparian habitat may not be adequate to support species utilizing it.

a. What was the historic composition of the riparian vegetation? How does that compare to current conditions?

b. What is the historic role of disturbance in the riparian areas? How does the historic disturbance compare to the current conditions?

c. Will the interim riparian reserves and matrix standards and guidelines adequately provide all 5 functions outlined in the ROD?

Table 1-25

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Historic vegetation and fire maps	No	District wide	Use maps produced in question 1.	
Literature on fires and other disturbance	Yes	Regional	Literature Search	

Description of General Analytical Process:

- Compare current vegetation condition in the riparian areas from the VEGIS database to the historic condition as indicated by REAP and the historic state fire and vegetation maps. For wilderness area, use the data collected by Jane Kertis and the prescribed natural fire group.

PRODUCTS:

- Narrative comparing current and historical conditions.

d. What criteria would lead to interim riparian reserve adjustments, and where are some of the areas that fit these criteria?

e. What are the appropriate riparian reserve boundaries for this landscape?

Table 1-26

DATA NEEDED	EXIST
LMP Layer	Yes
Veg Layer	Yes
SHAB Layer	Yes
Stream Layer	Yes

Description of General Analytical Process:

- IDT review layers and discuss biological implications of alternatives.

Issue:

Grazing of pack animals in wilderness areas may be impacting riparian areas to an extent outside of wilderness objectives.

a. Where and what kind of disturbance has occurred?
b. Where are areas with the highest potential for degradation in the future?

Table 1-27

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Wilderness campsites used by stock rate high, med, low	Yes		Hard copy from Troy's data	
Location of water closest to those sites	Yes		Stream layer on GIS	

Description of General Analytical Process:

- Take wilderness permit data for last four seasons, break out those identified as stock users, note trailhead entrance points. Through consultation with Steve O., Phil, Stacey, and through LAC inventories, identify low, moderate, and heavy stock use campsites. Overlay a water/stream layer, and through inference determine riparian areas that are at a low/medium/high risk for grazing impacts. Recommend an appropriate sampling procedure for future field verification and restoration projects.

Issue:

Grazing of Forest Service pack animals at Fish Lake and cattle at Lava Lake is occurring. This activity, combined with manipulation of the stream channel and riparian vegetation may be degrading stream channel conditions and fish habitat; may be degrading wetlands; and may be altering the vegetation composition of the area.

a. What are the natural functions and processes occurring within these areas?

b. In Terms of the ROD's 5 objectives for riparian reserves, what is the current biological condition of these areas?

c. What roles do these areas play in a larger landscape?

d. What effects have grazing and channel manipulation had on stream channel condition, function and aquatic habitat in these areas?

Table 1-28

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Fish Lake Analysis	Yes	Fish Lake		Paper
Lava Lake EA	Yes	Lava Lake		Paper

TERRESTRIAL DOMAIN

Issue:

Insects and diseases are affecting forest health and resilience in many of the stands within the analysis area. Of particular interest are the spruce budworm infestation, the Douglas-fir bark beetles, the root rots, and the dwarf mistletoe.

a. What is the extent and severity of insect and disease effects?
b. How do current conditions compare with historic conditions?
c. Do the current conditions present a significant risk of large-scale fires?

Table 2-1

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Maps of recent insect and disease infestations	Yes	District Wide	GIS	GIS - Paper
Information on historic insect and disease infestations	No	District Wide	Interpolate from literature and historic vegetation maps	Paper
Relative Risk of Large Stand Replacing Fire	No	Regional	Literature search, including Swanson and Morrison (Deer Creek) Fuel Models	Paper

Description of General Analytical Process:

1. Vegetative condition is directly related to insect and disease levels. Use historic vegetation condition to infer insect and disease levels. Compare current insect and disease conditions to inferred historic levels.

2. Use fuel models to compare current risk of large scale fires with historic records of such fires to determine a relative difference.

PRODUCTS:

- Narrative describing role of insects and diseases in historic and current context
- Narrative describing historic and current risks of large scale fires.

Issue:

Management activities within these forests, including timber harvest, road building, and fire exclusion, may have altered species' composition and created patterns and conditions that are outside of the historic range. This could impact the biological diversity of the watershed.

a. How does the current condition of vegetation compare with the historic range? How do these changes affect land management objectives, ecosystem function, and structure?

b. Are there individual plants and plant communities that are decreasing or increasing due to past management activities? What wildlife are associated with these plant communities?

Table 2-2

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Guild Habitat maps Basin & Watershed	Yes	1" = 1 mile		
Guild maps for 1900 landscape	No			

Description of General Analytical Process:

1. Determine acres of habitat by Guild for watershed and basin; and calculate % contribution of watershed to basin.
2. Evaluate distribution of habitat for corridors, barriers, etc.
3. Compare historic landscape to existing.

Table 2-3

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Map of 1900 landscape	Yes			
Map of 1994 landscape	Yes			
REAP report	Yes			
WHR database	Yes			

Description of General Analytical Process:

1. Compare 2 landscapes and structures that develop under natural versus "managed" disturbances. Identify trends in habitat structures and link species to the structures using WHR database.

Table 2-4

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Ecoplot database	Yes V010	UPMA		Paradox D.B.

Description of General Analytical Process:

1. Use existing info to assess if any plant sp/plant community is increasing or decreasing in UPMA.

c. What was the role of human-set fire in altering the vegetation patterns in the prehistoric past? Is there any evidence for this in the archaeological record?

Table 2-5

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Historic Vegetation maps and fire history maps	Some	District wide	Historic State forest stand and fire maps	Paper
Current vegetation	Yes	District Stands	GIS, Vegis database	Paper
Role of Prehistoric Fires	Yes	Regional	Literature search	
Information on vegetation of wilderness areas	Yes	Forest	Jane Kertis database and Pacific Natural Fire	GIS

Description of General Analytical Process:

1. Compare current vegetation condition from the VEGIS database to the historic condition as indicated by REAP and the historic state fire and vegetation maps. For wilderness area, use the data collected by Jane Kertis and the prescribed natural fire group.

PRODUCTS:

- Map of historic structural stages
- Map of current structural stages.
- Narrative describing aboriginal use of fire in the watershed.

Issue:

Levels of large woody debris and snags in managed stands, campgrounds, roadsides, etc. may be below historic levels for these systems. This could impact a variety of species that depend on these elements for habitat.

a. What is the natural range of variability for LWD on this landscape?

b. Have management activities altered the landscape condition significantly outside the historic range for snags and LWD?

Table 2-6

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Current snag and LWD levels and distribution	Yes	District wide	GIS	Table
Historic snag and LWD levels and distribution	No	Regional	Extrapolation of existing natural stand	Table

Description of General Analytical Process:

1. Examine existing undeveloped forest stands in each broad plant series to determine historic levels of snags and LWD. Consider fire patterns into extrapolation of historic snag and LWD. Based on current fire patterns and assumptions of management practices, determine existing levels of snags and LWD for the watershed.

PRODUCTS:

- Narrative and table comparing current and historic levels of snags and large woody debris.

Issue:

The public expects a variety of commodity outputs from this area, however, meeting those expectations may conflict with other objectives or may not be sustainable.

a. What are the suitable and available areas in the watershed?

b. Where are the potential areas for harvest of special forest products in the watershed?

Table 2-7

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Ecoplot database	Yes V010	UPMA		Paradox database

Description of General Analytical Process:

1. Look at ecoplot database to assess high concentration of SFP species.
2. Look at past SFP harvest areas.
3. Talk to district personnel who may have knowledge of areas of high concentration of SFP plants.

PRODUCT:

- Narrative and list of locations, possibly a map w/locations.

Table 2-8

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Suitable and available acres in the watershed	Yes	District wide	GIS - "What's available Map"	GIS - Paper
Areas open for special forest products	Yes	District wide	GIS - map of areas suitable for collection of various special products	GIS

Description of General Analytical Process:

1. Acres suitable and available for various types of commodity production will be displayed in a tabular format.

Issue:

Future land management strategies focused on the maintenance or development of late-successional forest species may result in diminished availability of habitat for early seral species.

a. What is the historic and projected future availability of early, mid and late seral habitat over time in this watershed?

b. How will the availability and distribution of these habitat types affect species associated with them over time?

(see 2-2 through 2-5)

Issue:

The road management strategy for the watershed may be affecting the quality of wildlife habitat and hunting opportunities.

a. What are the current road densities within the watershed? How do they currently impact wildlife habitat and hunting opportunities?

Table 2-9

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Road density Data	Yes			
EHAB	Yes			
Wildlife habitat/species locations	Yes			

Description of General Analytical Process:

1. Run HEIWEST for HE values.
2. Compare with forest plan objectives.
3. Overlay roads and wildlife habitat areas and look for impacts.

Table 2-10

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Map of areas with open roads	Yes			
Map of areas within open 1 mile of open roads	No			

Description of General Analytical Process:

1. Identify zones of hunting opportunities: ie. areas within .5 mile ,etc. of open roads. Evaluate acres and elk use.

Issue:

Some current recreation uses conflict with other uses or management goals. Areas such as Sawyer's Cave provide both recreation opportunities and critical wildlife habitat.

a. Where are recreation use areas conflicting with T, E and S species and species of concern?

Table 2-11

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Map of TES species	Yes	1" = 1 mile		
Map of Rec. areas	Yes			

Description of General Analytical Process:

1. Overlay maps of TES and recreation use and identify over-laps.
2. Determine if type of use is in conflict with species' sensitivity to disturbance.

Issue:

Diversity (i.e. horizontal structure, species mix, stocking levels) in past harvest areas may be providing low quality habitat for species that rely on early seral stages.

a. What is the current diversity level within managed plantations? How does this compare with historic early seral stage habitat?

Issue:

The Northwest Forest Plan calls for the survey and management of numerous species of wildlife, fungi, lichens, bryophytes and vascular plants (ROD Table C-3). The location of many of these species is unknown. The Standards and Guidelines in the Northwest Forest Plan may not adequately protect these local endemic and rare species when applied at a site-specific level.

a. What C-3 species may potentially occur in the watershed based on their range and habitat requirements?

b. What Table c-3 wildlife and plant species know to occur in the watershed?

Table 2-12

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Wildlife sitting's mapped	In progress	1" = 1 mile		
Range maps of C-3 species	Yes			
Great Gray owl sites	Yes	1" = 1 mile		
Seral stage map	Yes	1" = 1 mile		
Meadow map	Yes	1" = 1 mile		

Description of General Analytical Process:

1. Review documented locations and existing range maps.
2. Review habitats within .25 miles of GGO nest sites and distance to nearest meadows.

c. Do the NFP standards and guidelines adequately protect existing habitat or provide long-term habitat for species targeted within the Plan?

d. What is required for the maintenance of these species or their habitat?

Table 2-13

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Current Veg.	Yes	1" = mile		

Description of General Analytical Process:

1. Use model of projected landscape under NWFP and known locations and analyze:
   - Great Grey - % of openings vs. closed canopy/OG over time.
   - 3-toed - snag levels.
   - Tree Vole - % of OG, dispersal corridors in OG condition.

Table 2-14

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Appendix J2/ Table C-3 spp. database	Yes	UPMA		Paradox database
FSEIS ROD WNF Plan	Yes	UPMA		paper
Map of potential habitat for these spp.	No	UPMA	GIS Veg layer, riparian layer, and SHAB layer	GIS

Description of General Analytical Process:

1. Check existing info for spp. presence in UPMA. and habitat requirements.
2. List documented sightings in UPMA.
3. List species that may potential occur in the UPMA.
4. List mgmt strategies and S&Gs required for Table C-3 species.

PRODUCT:

- Narrative, report and map or potential habitat for species.

Issue:

Because a portion of this watershed lies along the crest of the Cascades, it functions as an ecotone between east and west side ecosystems. Standards and Guidelines within the Northwest Forest Plan that pertain specifically to westside systems may not be appropriate for this area.

a. What areas within the watershed function as an ecotone?
b. What eastside S&G's within the NWF Plan are more applicable to this area?

Table 2-15

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Veg series map	Yes			

Description of General Analytical Process:

1. Review series near crest for disturbance histories and applicability of eastside S & G's.

Issue:

The watershed must continue to contribute to the recovery of several threatened and endangered species, and also maintain or increase the populations of rare or sensitive species.

a. What TES species are known to occur or potentially occur within this watershed?

b. What is the condition of their populations and habitat?

Table 2-16

DATA NEEDED	EXIST?	RESOLUTIO N	COLLECTION METHODS	MEDIA
Documented sighting reports of sensitive plants	Yes V020	UPMA		paper and GIS point layer
Non-forested habitats	Have some info and currently collecting V012	UPMA	Aerial photos	GIS

Description of General Analytical Process:

1. Assess habitat quality and viability of species. Assess the potential habitat for sensitive plants in UPMA.

PRODUCT:

- List of documented species in UPMA. and quality of their habitat. List of sensitive spp. that may potentially be found in the watershed. List habitat types for future surveys.

c. What is the status of the TE species recovery, and how must this landscape contribute?

Table 2-17

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
TE species map	Yes			
50-11-40& Take & CHU analysis	Yes			
LSR analysis LSR's map	Yes			
Habitat around lakes	Yes			
Cliff Habitat	Yes			

Description of General Analytical Process:

1. Map of capable, current and potential owl habitat. Compare with 11-40 rule.
2. Analyze land allocations dispersal habitat exists in.
    - Analyze acres of OHAB within 1.2 miles of sites.
    - Analyze acres of owl habitat in LSR's.
    - Map late successional habitat around lakes and reservoirs.
    - Map cliff habitat.

Issue:
Road right of ways may not be meeting all legal or environmental obligations (i.e. maintenance and "take" issues).

a. Does potential exist for conflicts between access administration and taking of threatened or endangered species?
b. Does potential exist for conflicts between access administration and maintenance?

Table 2-18

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Map of road right of ways	NO	1" mile	See Pat Hutchins	Hard copy

Description of General Analytical Process:
1. Route map of existing right-of-ways to team to see if conflicts exist.
2. Write a narrative.

Table 2-19

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Map of private timber inholdings	Yes	1"		
Map of F.S. roads that may access these properties	Yes	1"		
Data on owls in take situation	Yes	1"		
Location of peregrine sites	Yes	1"		

Description of General Analytical Process:
1. Overlay maps above to see what private inholdings are in the vicinity of peregrine and owl sites.
2. Review road access to identify Forest Service roads that could be used to haul timber from private lands.

Issue:
The majority of sensitive and rare plant species that are known or suspected to occur in the watershed occupy non-forested areas (special _habitats). These areas, though protected by S&G's, are generally unmapped and unsurveyed. It is unknown what their current contribution to biodiversity on the landscape is or what threats may need to be recognized.

a. Where and what kind of special habitats are present within the watershed?

b. Are there special habitats within the watershed that have limited distribution across the watershed/Forest/ or Region?

c. What threatens the continued stability or functioning of these special habitats?

d. What wildlife and botanical species of interest are associated with these areas?

Table 2-20

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
SHAB identified and typed	Some V012	UPMA	Aerial photos	photos
Field verification of selected SHABs	Some V012	UPMA	Past field inventories, and current field reconnaissance.	paper
Past and current mgmt activities near SHABs	Some	UPMA	Harvest areas identified District personal.	GIS, paper, per. com.

Description of General Analytical Process:

1. Aerial photo interpretation for SHABs. Digitize into GIS. Assess stability of SHABs across the watershed. Assess mgmt activities around SHABs.

PRODUCT:

- Narrative and GIS map.

Table 2-21

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Special habitat map	Yes		Use SRI, special features, and manuscripting	
Franklin and Dyrness reports Forest analysis	Yes Yes			
WHR database	Yes			

Description of General Analytical Process:

1. Research on distribution.
2. Research on threats.
3. Query WHR for species associated.

Issue:

Important geological resources may be at risk from management activities and knowledge of their locations may be lost.

a. Are there areas of unique geologic research value (fossils or formations) that could be damaged or destroyed by management activities?

Table 2-22

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Location areas of fossils, or geologically unique areas of research or interpretive value	Yes No		Literature search of UofO, DOGAMI, and personal interviews with geology/geography dept. staff at UofO/OSU/District.	

Description of General Analytical Process:

1. Determine if areas exist in the watershed that should be protected under American Antiquities Act, or areas that contain geologic formations of unique research and interpretive value.
    - Literature search and personal interviews with UofO, OSU, and State Department of Geology staff.
    - Produce map of any previously unknown areas.

Issue:

Transmission line corridors may be impacting riparian areas, water quality, wildlife habitat, recreation developments, and heritage resources.

a. Have the transmission line corridors facilitated the invasion and establishment of noxious weeds?

Table 2-23

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Presence of noxious weeds in line corridors.	Some	Transmission lines in UPMC	Aerial photo interpretation.	Photos
Past TES surveys	Some V020	UPMA		Paper
Past records	Yes	UPMA	Check with Pat Hutchins for original records.	Paper
EWEB info, past work in corridors.	Yes	UPMA		

Description of General Analytical Process:

1. Cross reference early aerial photos with latest aerial photos for presence of noxious weeds/ground disturbance.
2. Read through original papers of project. Read past BE's for documentation of noxious weeds.

b. Where has riparian/upland vegetation, water quality, and stream channel processes been modified by maintenance of vegetation within transmission line corridors?

c. What is the effect of transmission line corridors on wildlife species?

Table 2-24

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Map of corridor	Yes	1"		
Map of TES and other special habitats	Yes	1"		

Description of General Analytical Process:

1. Overlay and review impacts.

Issue:

Trailbridge Reservoir flats and Carmen Reservoir , which resulted from the construction of the Carmen/Smith project, are experiencing soil compaction, noxious weed invasion and establishment, and the loss of native vegetation.

a. What are the current vegetative and soil conditions of these areas?

b. What actions compatible with the recreation goals for the area are needed to correct or improve these areas?

Table 2-25

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Reports and personal communications	Yes	Trailbridge and Carmen areas		Paper per. com.

Description of General Analytical Process:

1. Assess current conditions of areas. Identify potential activities that may be implemented to improve the current conditions.

PRODUCT:

- Narrative.

SOCIAL AND ECONOMIC DOMAIN

Issue:

There may be conflicts between economic growth and resource conditions. Demands influencing campgrounds, wildlife (hunting and viewing), fishing regulations may change visitor use.

a. What actions in the future may change the tourism generated economic benefits to the local economy?

Table 3-1

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Existing Visitors Profile	Yes		Reports on Scenic Byway, State Scorp.	
Amount of Existing Use	Yes		RRIS for past 5 years.	

Description of General Analytical Process:

1. Sources include- A Report prepared by Dean Rynyan Associates conducted for the McKenzie Pass/Santiam Pass National Scenic Byway Interpretive Plan, entitled "Interpretive Audience Analysis, The Central Cascades, Oregon. The report consists of a visitor profile and visitor demographics, and focus on the visitors who would be going to recreation destinations within this watershed analysis area. Another report is "Initial Social Assessment of Proximate Communities for the Central Cascades Adaptive Management Area (1/95) by Bruce Shindler, et al, Oregon State University. SCORP report for Oregon will also provide some demand trends for different recreation activities. A draft report on the issue of privatization of future recreation developments on National Forests will also be reviewed for information. Marketing of National Forests by State Tourism Boards.

Issue:

Significant recreational use of the Upper McKenzie may be focused on use of fishery resources. Conflicts over the use of this resource may occur in the future as use increases.

a. What is the economic and sociological contribution of fisheries in the Upper McKenzie sub-basin?

Issue:

In some locations, conflicts exist among some recreationist who are participating in various legitimate recreational activities on the forest.

a. Where do conflicts currently occur between recreationists?

Table 3-2

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Opinions of Recreation managers	No		Discuss among Trails/Wilderness/Developed Sites/Winter Sports etc.	Narra-tive.

Description of General Analytical Process:

1. Discussion of water skiers and fishing at Big Lake; use of campgrounds by large groups who actually need a group reservation area; campgrounds having reservation vs. users who want spontaneity; large groups who want to hike and party sizes in wilderness; snow play vs. x-country vs. snowmobile; horse users looking for day rides having primarily wilderness trails available where conflicts with hikers can occur. Draw some conclusions, where possible, about what these conflicts mean for existing and future capacities for various recreation opportunities.

Issue:

Parts of this watershed area are used by ATV's (all terrain vehicles), which can impact vegetation, soils and botanical/wildlife resources.

a. Where within the watershed is ATV use prevalent? and where and how is the use impacting other resources?

Table 3-3

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Map of ATV Travel Areas	Yes	1" Mill?	Larry Wilson	Hard Copy
Numbers, Types, of ATV's	No		Jim Denney's 94 Season information on ATV Encounters.	Narra-tive.

Description of General Analytical Process:

Document the 1994 season field contacts by Jim Denney with ATV riders in the Big Lake Burn Area. Summarize the numbers of riders encountered and label routes by types of riders and low, medium, high use. Use Larry Wilson's map of the burn and show his estimates of erosion damage by different routes. Have this information reviewed by specialists for resource damage potentials and recommendations.

Issue:

Enforcement of heritage resource preservation and artifact protection laws is a problem. Few forest visitors are aware that even the waste material (i.e., flakes) of obsidian tool protection is protected by law from illegal collecting.

a. To what extent are prehistoric heritage resources being damaged by illegal collecting?

Table 3-4

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Info on Forest Visitor behavior	No		Questionaire survey (?)	
Info on Arch. site changes	P001	Good	Review original site forms, updates, and monitoring forms	Paper - reports
Evidence for theft	No		Stratified sample survey of known sites	
LEO records	Yes	Unk	Interview LEO	

Description of General Analytical Process:

1. Draft a mailing questionaire, send to user groups; interpret results.
2. Review site files, compile listing on site condition changes.
3. Summarize data and findings to answer questions.
4. Interview LEO's.

Issue:

Administration, grazing, and recreation uses at Fish Lake may be impacting heritage resources.

a. To what extent is use of Fish Lake impacting heritage resources?

Table 3-5

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Info on admin use changes to buildings	No	Individual buildings	Interview with Jim Denney; field observer	
Data regarding arch. site changes in lakebed	P001/ No	Some good info; needs update (lakebed)	Interview with Jime Denney; field inspection of SWR.	Paper - Reports

Description of Analytical Process:

1. Interview Fish Lake guard regarding data needed above, conduct bield survey when snow clears.
2. Summarize results and info in site files and Oracle data base.

Issue:

Recreational use is resulting in damage to severe historic structures.

a. What historical structures/areas occur within the watershed?

Table 3-6

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Comprehensive listing of list, structures	P001; Oracle data base	Quads; point specific, too.	File review; base map review.	Paper - Reports
Comprehensive listing of areas	P001/ No		Back ground research; file review.	Uport/ map overlay

Description of General Analytical Process:

1. Review base maps, plot sites/structures/areas on GIS; output map and prepare listing; overlay on basemap of watershed.

b. What damage is occuring to the structures?

Table 3-7

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Damage assessment	P001/ No	Building specific	Interviews; field surveys.	Paper - reports

Description of Analytical Process:

1. Interview those "in the know" - field surveys of buildings when access clears.
2. Summary report to answer questions.
3. Reviews of HR building files.
4. Arrange for damage assessments.

c. Where are unacceptable levels of damage occurring?

Table 3-8

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Definition of what is acceptable	Sec'y of interior standard s	National standards	Research regs, interview Forest Arch.	Sum-mary report
Application of standards to damage assessments	No	Buildings specific	Compare with damage assessments.	Sum-mary report

Description of General Analytical Process:
1. Office review of regulations, consultation with Forest Archeologist.

Issue:
Impacts to the scenic quality of natural features may be occurring from degradation caused by rock sources, insect and disease mortality, and harvest units.

a. What existing conditions are inconsistent with the Scenic Byway, Wild and Scenic River, and Forest Plan?

Table 3-9

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
LMP layer on GIS	Yes	1" mile	Done - except for updates to 12A, Developed Sites.	
Review Forest Plans, Scenic Byway, W & S River	Yes		Read Plans	Narra-tive

Description of General Analytical Process:
1. Use the ROS/VQO/VEGIS analysis in Recreation Question 1, use description as a starting point, from the Scenic Byway Appendix. Contact Bob Loncore for specialist's input and description.

Issue:
Prescribed Natural Fire (natural or management ignited) is within designated Class 1 airsheds which may be limited by air and good visibility, and the ecological need for using PNF as an ecosystem management tool, may conflict.

a. What was the historical air quality 1850-1900?

Table 3-10

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Estimate of PM-10 and acres burned	Yes	Region west Oregon	Review existing work	Table Text

Description of General Analytical Process:
1. Research and Document existing work as a reference to this WA.

b. What is the current NAAQS and benchmark for our areas?

Table 3-11

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Standards	Yes	Wild/non-wild	Read and Cite	Text
Curent Aug. status of summer airshed	Yes	Region	Read and Cite Smoke mgmt reports	Text Table

Description of General Analytical Process:

1. Research and document smoke management reports for past few years.

Issue:

Allocations of funds have been too limited to accomplish all land adjustments of those lands may be a benefit to resources on those and surrounding parcels.

a. Which parcels of land are available? and what are the resource benefits of Government ownership of each?

b. What are the priorities for acquisitions based on resource benefits?

Table 3-12

DATA NEEDED	EXIST?	RESOLUTION	COLLECTION METHODS	MEDIA
Discuss Land Potentials.			Pat and Phil	Narra-tive
Draw out map of potentials.	No	1" mile		Hard Copy

Description of General Analytical Process:

1. Route private land with forest zoning to team, see if any adjacent private lands appeal important for National Forest Management goals?.

APPENDIX D

PUBLIC INVOLVEMENT

PUBLIC INVOLVEMENT

An effort to contact interested publics and organizations occurred through several processes over the course of the analytical process:

1. The Watershed Analysis Team conducted a public meeting on Feb. 28, 1995 to discuss the watershed with interested publics.

2. A draft of the significant issues was published in the McKenzie Ranger District Quarterly Newsletter in March, 1995.

3. A draft of the significant issues was mailed to publics and organizations on the McKenzie and Sweethome Ranger District's mailing lists. Comments received were reviewed by the WA team.

4. Each team member contacted a variety of publics and counterparts in other agencies to obtain available information.

5. The draft significant issues were given to the McKenzie Watershed Council for review and comment.

APPENDIX E

ADDITIONAL DATA

SILVICULTURE APPENDIX

OVERVIEW OF DEVELOPMENT PATTERNS

(Adapted from Oliver and Larsen 1990).

Stand development after a stand-replacing disturbance—

Stages of development:

Stand Initiation Stage:
Growing space is reoccupied following a stand-replacing disturbance, such as fire.

Stem Exclusion Stage:
Occurrence of new tree stems is excluded by limits on light or moisture. The canopy is closed and crowns recede.

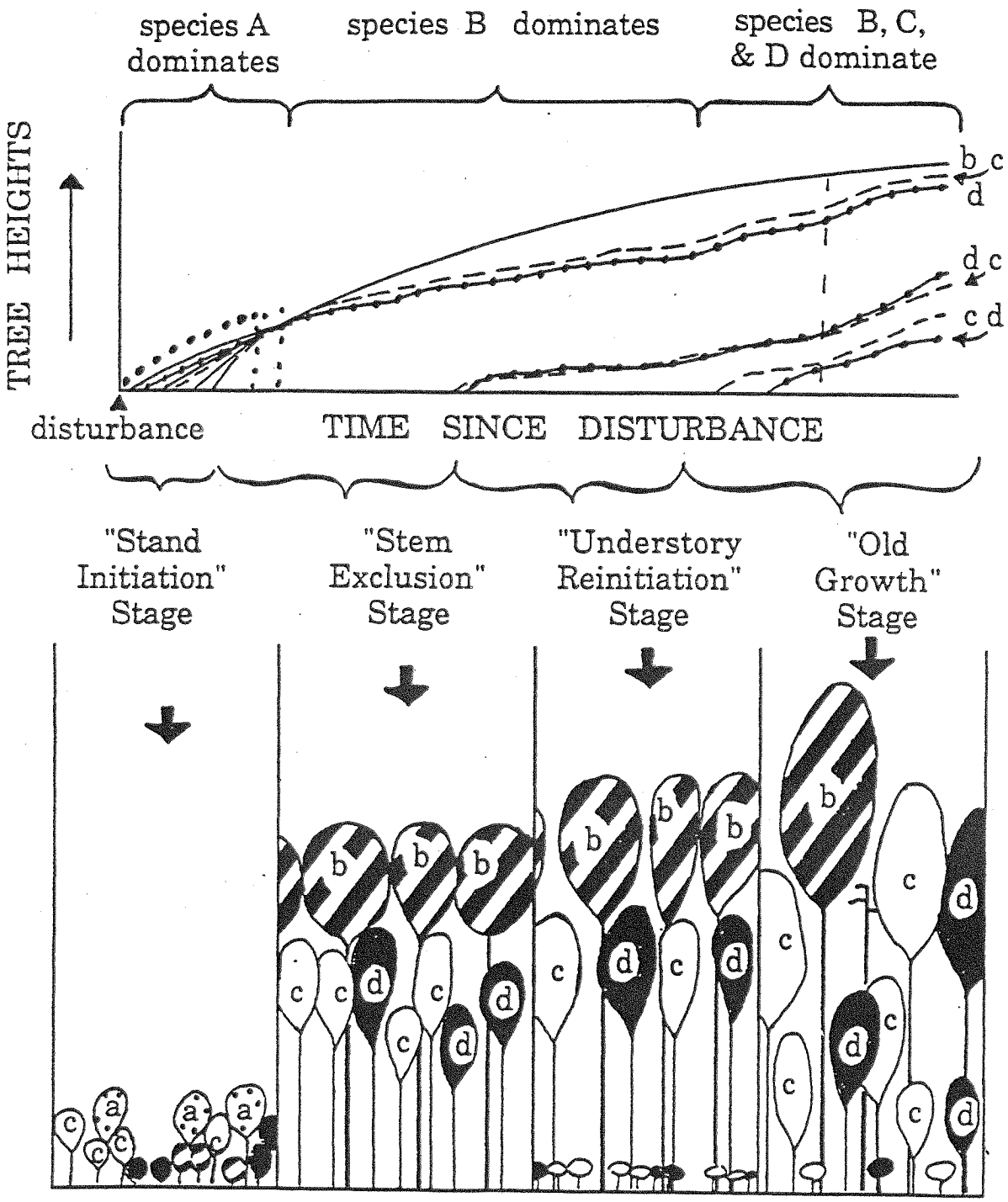
Understory Re-initiation Stage:
Second cohort established under older overstory. Mortality in the overstory creates growing space for new trees in the understory.

Old-growth Stage:
Multi-cohort, multi-strata stands with large, old trees.

Stand Development after minor disturbances—

Uneven-Age, All-aged, Multi-cohort:
These stands develop after disturbances that leave much of the original stand intact. Minor disturbances can include fire, logging, windthrow, insects and diseases. Single trees or cohorts become established in the created openings. The number of ages can be affected by the degree and frequency of the disturbance.

Development Patterns



ACRES SUITABLE AND AVAILABLE IN THE WATERSHED

The total Upper McKenzie Watershed contains about 230,924 acres. After subtracting areas set-aside by Congress, areas set-aside by the Willamette Forest Plan, and areas set-aside by the President's Forest Plan (including riparian reserves), the watershed contains about **85,453** acres suitable and available for timber management. This amount is about **37%** of the watershed.

Stand development descriptions used throughout the Upper McKenzie Watershed analysis.

TREE SIZE DESCRIPTION	STAGES OF DEVELOPMENT (C.Oliver 1990)	WILDLIFE HABITAT DESCRIPTION	DBH	SERAL STAGE	SIZE CLASS	PSME SITE IV	ABGR SITE III	TSHE SITE II	TSHE SITE III	ABAM SITE IV	ABAM SITE V	TSME SITE IV
SEEDLING	Stand Initiation	Grass/forb/shrub	>6" TALL	EARLY	1	E	E	E	E	E	E	E
SEEDLING AND SAPLING	"	Open Sapling-pole	1" - 5"	EARLY	1.5	E	E	E	E	E	E	E
SAPLINGS	"	"	1" - 5"	EARLY	2	M	E	E	E	E	E	E
SAPLINGS AND POLES	Stem Exclusion	"	1" - 5"	EARLY	2.5	M	M	M	M	M	M	M
POLES	"	Closed Sapling Pole	5" - 9"	MID	3	M	M	M	M	M	M	M
POLES AND SMALL TREES	"	Open Small Conifer	5" - 9"	MID	3.5	M	M	M	M	M	M	M
SMALL TREES	"	Closed Small Conifer	9" - 21"	MID	4	M	M	M	M	M	L	M
SMALL & MEDIUM TREES	Understory Reinitiation	"	9" - 21"	MID	4.5	L	M	M	M	L	L	L
MEDIUM TREES	"	Large Conifer	21" - 32"	LATE	5	L	L	L	L	L	L	L
MEDIUM AND LARGE TREES	"	"	21" - 32"	LATE	5.5	L	L	L	L	L	L	L
LARGE TREES	Old Growth	Old Growth	32" - 48"	LATE	6	L	L	L	L	L	L	L
LARGE AND GIANT TREES	Old Growth	"	32" - 48"	LATE	6.5	L	L	L	L	L	L	L
GIANT TREES	Old Growth	"	> 48"	LATE	7	L	L	L	L	L	L	L

PSME: Douglas Fir
ABGR : Grand Fir
TSHE: Western Hemlock
ABAM: Pacific Silver Fir
TSME : Mt. Hemlock

BOTANY APPENDIX

Modifying Riparian Reserves:

The draft Terrestrial Ecology Addendum (1995) contains a list of survey and manage species and other riparian zone plants that must be considered prior to modifying riparian reserve boundaries. Species range and habitat was analized, species not suspected to occur in the watershed were deleted. Only vascular plants were deleted from list.

Survey and Manage Species:

Bryophytes:

Kurzia makinoana
Marsupella emarginata var. aquatica
Scouleria marginata
Tritomaria exsectiformis

Lichens:

Cetrelia cetroids
Collema nigrescens
Dermatocarpon luridium
Hydrothyria venosa
Leptogium burnetiae var. hirsutum
Leptogium cyanescens
Leptogium rivale
Leptogium saturninum
Leptogium teretiusculum
Platismatia lacunosa
Ramalina thrausta
Usnea longissima

Fungi:

Galerina sphagnicola
Helvella compressa
Helvella crassitunicata
Helvetta elastica
Helvetta maculata
Polyozellus multiplex
Phlogiotis helvelloides
Rickenella setipes

Vascular Plants:

Botrychium minganense
Coptis trifolia
Corydalis aguae-gelidae
Habenaria orbiculata

Non Survey and Manage Species:

Vascular Plants:

Adiantum pedatum
Aralia californica
Asarum caudatum
Dryopteris austriaca
Gymnocarpium dryopteris
Habenaria saccata
Lysichiton americanum
Menziesia ferruginea
Mitella breweri
Mitella caulescens
Mitella ovalis
Mitella pentandra
Poa laxiflora
Scoliopus hallii
Streptopus amplexifolius
Streptopus roseus
Taxus brevifolia
Thuja plicata
Tiarella unifoliata
Vaccinium membranaceum
Viola glabella

Survey and Manage Plant Species Found in the Watershed

Species	Category	Survey Strategy	Location
Cantharellus cibarius	Chantrelle	3,4	
Gautieria magnicellaris	Rare False Truffle	1,3	Mt Washington Wilderness.
Rhizopogon atroviolaceus	False Truffle	3	Santiam Pass, Airstrip burn.
Rhizopogon inquinatus	Rare False Truffle	1,3	Tombstone Pass.
Thaxterogaster pingue	False Truffle	3	Lost Lake, Scott Lake, Tombstone Prairie.
Plectania melastoma	Uncommon Cup Fungi	3	Deer Creek.
Lobaria oregana	Nitrogen-fixing Lichen	4	Mature and old-growth forests below 3000′.
Lobaria scrobiculata	Nitrogen-fixing Lichen	4	Mature and old-growth forests below 3000′.
Nephroma occultum	Rare Nitrogen-fixing Lichen	1,3	Fish Lake Creek.
Nephroma resupintum	Nitrogen-fixing Lichen	4	Near Fish Lake Creek, upstream from Clear Lake.
Pseudocyphellaria rainierensis	Rare Nitrogen-fixing Lichen	1,2,3	Koosah Falls
Tholuma dissimilis	Rare Leafy (arboreal) Lichen	1,3	Iron Mtn.
Allotropa Virgata	Vascular plant	1,2	MK-1010,6555,6584,6592,6593,6594,6604,6607, 6612,6669,6673,6723,8317,8327,8331,8332.
Botrychium montanum	Vascular plant	1,2	Browder & Pyramid Creek.

Noxious Weeds Found in the Watershed

Common Name	Scientific Name	Distribution	Biological Control
Spotten knapweed	Centaurea maculosa	Patchy	Yes
Canada Thistle	Cirsium arvense	Widespread	Yes
Bull Thistle	Cirsium vulgare	Widespread	Yes
Scotch-broom	Cytisus scoparius	Widespread	Yes
St. John's-wort Wa	Hypericum Perforatum	Widespread	Yes
Tansy ragwort	Scencio jacobaea	Patchy	Yes

Non-Native Plants Found in the Watershed *

Common Name	Scientific Name	Distribution	Biological Control
Bentgrass	Agrostis alba	Isolated	
Bitter wintercress	Barbarea vulgaris	Isolated	
Field mustard	Brassica campestris	Isolated	
Oxeye daisy	Chrysanthemum leucanthemum	Isolated	
Orchard grass	Dactylis glomerata	Patchy	
Queen Anne's-lace	Daucus carota	Patchy	
Teasal	Dipsacus fullonum	Isolated	
Wall lettuce	Lactuca muralis	Patchy	
Yellow toadflax	Linaria vulgaris	Isolated	
Annual rye	Lolium perenne	Patchy	
Bird's foot trefoil	Lotus corniculatus	Patchy	
Common forget-me-not	Myosotis scorpioides	Isolated	
Reed Canarygrass	Pharlaris arundinacea	Isolated	
Common Timothy	Pheum pratense	Patchy	
Common Plantain	Plantago lanceolata	Widespread	
Kentucky bluegrass	Poa pratensis	Patchy	
Sealheal	Prunella vulgaris var. vulgaris	Widespread	
Himalaya blackberry	Rubus discolor	Patchy	
Evergreen Blackberry	Rubus laciniatus	Patchy	
Red Sorrel	Rumex acetosella	Widespread	
Dandelion	Taraxacum offinale	Patchy	
Red clover	Trifolium pratense	Patchy	
White clover	Trifolium repens	Patchy	
Common mullen	Verbascum thapsus	Isolated	

* Excluding Wilderness Areas.

*Allotropa vigata** locations in the Upper McKenzie Watershed.

Landblock	Ecoplot	Plant Association	% of Coverage	Township	Range	Section	Elevation	RD
2A	6604	TSHE/ RHMA-BENE	1.00	15.00	6.00	4	2500	MK
2A	6723	TSHE/ RHMA-BENE	1.00	15.00	6.00	9	2540	MK
2B	6612	TSHE/ RHMA-BENE	1.00	14.00	6.00	35	2540	MK
3	6673	ABGR/ ARUV	1.00	13.00	7.00	15	3800	MK
3	8327	ABGR/ ARUV	1.00	13.00	7.00	15	3800	MK
4	8331	ABGR/ ARUV	1.00	13.00	7.00	32	3120	MK
4	6669	ABGR/ ARUV	1.00	14.00	7.00	9	3250	MK
4	1010	TSHE/ BENE	1.00	14.00	7.00	17	3100	MK
5	8332	TSHE/ RHMA-BENE	1.00	15.00	6.00	36	2900	MK
5	6584+	TSHE/ RHMA-GASH	1.00	15.00	7.00	17	2860	MK
5	6592	TSHE/ BENE	1.00	16.00	6.00	2	2000	MK
5	6593+	TSHE/ RHMA-GASH	1.00	16.00	6.00	2	2150	MK
5	6594+	TSHE/ RHMA-GASH	1.00	16.00	6.00	2	2180	MK
5	6555	TSHE/ RHMA/ LIBO2	1.00	15.00	6.00	36	3200	MK
6	8317	PSME-TSHE/ BENE	1.00	16.00	6.00	11	1600	MK
6	6607	TSHE/RHMA-GASH	1.00	16.00	6.00	15	2160	MK

* FEIS ROD Survey strategy 1: manage known sites, 1995.
+ Uncommon plant association in the watershaed.

Rare Forested Plant Associations in the Upper McKenzie Watershed.

Plant Association	Ecoplot	Landform Block
PSME/HODI-WHMO	6143	1 & 2B
PSME/HODI/GRASS	6602	2A
PSME-TSHE/BENE	Browder Ridge	2B
ABGR/BENE	Browder Ridge	2B
ABAM/RHAL/XETE	563	4
ABGR/CHUM	8328	4
PSME/HODI-WHMO	8338	5
PSME/SYMO	11164 & 11165	5
PSME/SYMO	11179	5
PSME/SYMO	6570 & 6624	5
PSME/SYMO	6581	5
SHAB MGMT GUIDE 1993: Rare: ≤ 5 sites on district;		

Unique Forested Plant Associations in the Upper McKenzie Watershed

Plant Association	RD Rating	Landform Block	Number of ecoplots
ABAM/RHMA-BENE	MK - C	2A	1 ecoplot
ABAM/RHMA-BENE	SH - U-C	2B	1 ecoplot
ABAM/RHMA-VAAL/COCA	SH - C	2B	2 ecoplot
ABAM/RHMA/XETE	MK - C	2B	1 ecoplot
ABAM/RHMA/XETE	SH - C	2B	4 ecoplot
ABAM/VAAL/COCA	SH - C	2B	2 ecoplot
ABCO	MK	4	2 ecoplot
TSHE/BENE/OXOR	MK - C	1	3 ecoplot
TSHE/LIBO2	MK - C	2A, 4 & 5	4 ecoplot
TSHE/RHMA-GASH	MK - C	5	5 ecoplot
TSHE/RHMA-VAAL/COCA	MK - C	5	1 ecoplot
TSHE/RHMA/XETE	MK - C	5	3 ecoplot
TSME/LUZULA	MK -U-C	5	1 ecoplot
Based on 305 ecoplots in watershed with forested plant associations. McKenzie Rd. 268 ecoplots & Sweet Home Rd. 37 ecoplots. SHAB MGMT GUIDE 1992: Rare:≤ 5 sites on district; Uncommon: 6-11 sites on district; Common: > 11 sites on district.			

Appendix Table C-3 Survey & Manage Species: Bryophytes, Fungi, Lichen, Vascular Plants

Bryophytes

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Antitrichia curtipendula	2	LS/OG	RZ, M/W	HW/C	low
Bartramiopsis lescurii	4	LS/OG	LDD		
Douinia ovata	3	LS/OG	RZ, M/W, RO		low to mid
Encalypta brevicolla var. crumiana	4	LS/OG	M/W, RO		
Herbertus aduncus	3	LS/OG	M/W, RO		low to high
Kurzia makinoana	3	LS/OG	RZ, LDD, M/W		low
Marsupella emarginata var. aquatica	3		RZ		mid to high
Plagiochila satoi	3	LS/OG	LDD, RO		low
Ptilidium californicum	1	LS/OG	LDD, M/W	ABCO	high
Scouleria marginata	3		RZ		
Tetraphis geniculata	3	LS/OG	LDD, M/W		low to mid
Thamnobryum neckeroides	5		M/W, RO		mid to high
Tritomaria exsectiformis	3	LS/OG	RZ, RO		low to high
Tritomaria quinquedentata	3	LS/OG	RO		

Fungi - Mycorrhizal

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Albatrellus avellaneus	3	LS/OG			
Albatrellus ellisii	3	LS/OG			
Albatrellus flettii	3	LS/OG			
Alpova alexsmithii	3	LS/OG		Abies spp., TSME	mid to high
Alpova sp. nov. # Trappe 9730	1	LS/OG		PSME	mid
Arcangeliella crassa	3	LS/OG	LDD	Abies spp., TSME	mid to high
Boletus haematinus	3			Abies spp.	high
Boletus pulcherrimus	3	LS/OG			low to mid
Cantharellus cibarius	1	LS/OG, 2G	LDD		
Cantharellus formosus	3	LS/OG	LDD		
Cantharellus subalbidus	3	LS/OG, 2G	LDD		
Cantharellus tubaeformis	3	LS/OG	LDD		
Catathelasma ventricosa	4	LS/OG			low to mid

Rating:1=Species present; 2=Species highly probable; 3=Species suspected; 4=Insufficient data on habitat and/or range to determine status; 5=Species not listed in Table C-3; listed in Appendix J2.
Seral Stage:LS/OG=late successional/oldgrowth; 2G=2nd growth.
Habitat:RZ=riparian zones; LDD=litter,down & duff; M/W=mesic/wet; D=dry; RO=rock outcrops,cliffs.
Trees:ABAM=Abies amabilis-Pacific silver fir; ABCO=Abies concolor-White fir; ABGR=Abies grandis-Grand fir; ABLA=Abies lasiocarpa-Subalpine fir; ABPR=Abies procera-Noble fir; HW/C=hardwoods & conifers; PICO=Pinus contorta-Lodgepole pine; PIMO=Pinus monticola-Western white pine; PSME=Pseudotsuga menziesii=Douglas-fir; THPL=Thuja plicata-Western redcedar; TSHE=Tsuga heterophylla-Western hemlock; TSME=Tsuga mertensiana-Mountain hemlock.

Appendix Table C-3 Survey & Manage Species: Bryophytes, Fungi, Lichen, Vascular Plants

Fungi - Mycorrhizal

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Choiromyces alveolatus	3	LS/OG	LDD	Abies spp., TSME	mid to high
Choiromyces venosus	3	LS/OG		HW/C, PSME	
Chroogomphus loculatus	3	LS/OG			mid
Cortinarius azureus	3	LS/OG			low to high
Cortinarius boulderensis	3	LS/OG			low to high
Cortinarius canabarba	4	LS/OG	LDD		
Cortinarius cyanites	3	LS/OG			low to high
Cortinarius magnivelatus	3	LS/OG			low to high
Cortinarius olympianus	3	LS/OG			low to high
Cortinarius rainierensis	4	LS/OG	LDD		
Cortinarius spilomius	3	LS/OG			low to high
Cortinarius tabularis	3	LS/OG			low to high
Cortinarius valgus	3	LS/OG			low to high
Cortinarius variipes	4	LS/OG	LDD		
Dermocybe humboldtensis	4	LS/OG			low
Destuntzia fusca	3	LS/OG		HW/C, Abies spp., PSME, TSHE	low
Elaphomyces subviscidus	3	LS/OG		Pinus spp.	mid
Gastroboletus imbelellus	3	LS/OG		Pinus spp.	mid to high
Gastroboletus ruber	3	LS/OG	LDD	TSME	mid to high
Gastroboletus subalpinus	3	LS/OG	LDD	PICO	high
Gautieria magnicellaris	1	LS/OG		Abies spp., TSME	high
Glomus radiatum	3	LS/OG	M/W		
Gomphus bonarii	3	LS/OG			
Gomphus clavatus	3	LS/OG			
Gomphus floccosus	3	LS/OG			
Gomphus kauffmanii	3	LS/OG			
Gymnomyces sp. nov. # Trappe 1690, 1706, 1710	1	LS/OG		ABAM,ABGR,ABPR,TSME	mid
Hebeloma olympiana	3	LS/OG			low to high
Hydnum repandum	3	LS/OG, 2G			
Hydnum umbilicatum	3	LS/OG, 2G			
Hygrophorus caeruleus	3	LS/OG			low to high

Appendix Table C-3 Survey & Manage Species: Bryophytes, Fungi, Lichen, Vascular Plants

Fungi - Mycorrhizal

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Ramaria concolor f. tsugina	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria coulterae	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria cyaneigranosa	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria fasciculata var. sparsiramosa	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria gelatiniaurantia	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria gracilis	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria hilaris var. olympiana	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria largentii	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria lorithamnus	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria maculatipes	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria rainierensis	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria rubella var. blanda	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria rubribrunnescens	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria rubrievanescens	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria rubripermanens	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria spinulosa	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria stuntzii	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria suecica	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria thiersii	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria verlotensis	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Rhizopogon abietis	3	LS/OG		Abies spp., PIMO	high
Rhizopogon atroviolaceus	1	LS/OG		Abies spp., PIMO	high
Rhizopogon brunneiniger	3	LS/OG		Abies spp., PSME, TSHE	low to high
Rhizopogon evadens var. subalpinus	3	LS/OG		Abies spp., TSME	high
Rhizopogon exiguus	3	LS/OG		PSME, TSHE	low
Rhizopogon flavofibrillosus	3	LS/OG			mid to high
Rhizopogon inquinatus	3	LS/OG, 2G	LDD	PSME	
Rhizopogon truncatus	3	LS/OG		Abies spp., PIMO	high
Russula mustelina	3	LS/OG			low to mid
Sarcodon fuscoindicum	3	LS/OG, 2G		Abies spp., PSME, TSHE, Pinus spp.	
Sarcodon imbricatus	3	LS/OG, 2G		Abies spp., PSME, TSHE, Pinus spp.	

Appendix Table C-3 Survey & Manage Species: Bryophytes, Fungi, Lichen, Vascular Plants

Fungi - Mycorrhizal

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Hygrophorus karstenii	3	LS/OG			low to high
Hygrophorus vernalis	3	LS/OG			low to high
Leucogaster citrinus	3	LS/OG	LDD	HW/C, PSME, TSHE	low to high
Leucogaster microsporus	3	LS/OG	LDD	PSME	mid
Martellia idahoensis	3	LS/OG		Abies spp.	mid to high
Martellia monticola	3	LS/OG	LDD	Abies spp., TSME	mid to high
Nivatogastrium nubigenum	3	LS/OG	LDD, D		mid to high
Phaeocollybia attenuata	3	LS/OG	M/W		low to high
Phaeocollybia californica	3	LS/OG	M/W		low to high
Phaeocollybia carmanahensis	3	LS/OG	M/W		low to high
Phaeocollybia dissiliens	3	LS/OG	M/W		low to high
Phaeocollybia fallax	3	LS/OG	M/W		low to high
Phaeocollybia gregaria	3	LS/OG	M/W		low to high
Phaeocollybia kauffmanii	3	LS/OG	M/W		low to high
Phaeocollybia olivacea	3	LS/OG	M/W		low to high
Phaeocollybia oregonenis	3	LS/OG	M/W		low to high
Phaeocollybia piceae	3	LS/OG	M/W		low to high
Phaeocollybia pseudofestiva	3	LS/OG	M/W		low to high
Phaeocollybia scatesiae	3	LS/OG	M/W		low to high
Phaeocollybia sipei	3	LS/OG	M/W		low to high
Phaeocollybia spadicea	3	LS/OG	M/W		low to high
Phellodon atratum	3	LS/OG, 2G		Abies spp., PSME, TSHE, Pinus spp.	
Polyozellus multiplex	3		RZ, M/W	Abies spp., Pinus spp.	mid to high
Ramaria abietina	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria amyloidea	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria araiospora	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria aurantiisiccescens	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria botryis var. aurantiiramosa	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria celerivirescens	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria claviramulata	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	
Ramaria concolor f. marri	3	LS/OG	LDD	Abies spp., PSME, TSHE, Pinus spp.	

Appendix Table C-3 Survey & Manage Species: Bryophytes, Fungi, Lichen, Vascular Plants

Fungi - Mycorrhizal

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Sedecula pulvinata	4	LS/OG	LDD	ABLA, TSME	mid to high
Thaxterogaster pingue	1		LDD	Abies spp.	mid to high
Tricholoma venenatum	4	LS/OG	LDD		low to mid

Fungi - Saprobes

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Aleuria rhenana	5	LS/OG	LDD		
Aleurodiscus farlowii	3	LS/OG	LDD		
Asterophora lycoperdoides	3	LS/OG	LDD		
Asterophora parasitica	3	LS/OG	LDD		
Baeospora myriadophylla	3	LS/OG	LDD		low to mid
Bondarzewia montana	3	LS/OG	LDD	Abies spp.	high
Bryoglossum gracile	5		M/W		high
Chrysomphalina grossula	3	LS/OG	LDD		low to mid
Clavariadelphus borealis	4	LS/OG	LDD, M/W	HW/C	
Clavariadelphus ligula	4	LS/OG	LDD, M/W	HW/C	
Clavariadelphus lovejoyae	4	LS/OG	LDD, M/W	HW/C	
Clavariadelphus pistilaris	4	LS/OG	LDD, M/W	HW/C	
Clavariadelphus sachalinensis	4	LS/OG	LDD, M/W	HW/C	
Clavariadelphus subfastigiatus	4	LS/OG	LDD, M/W	HW/C	
Clavariadelphus truncatus	4	LS/OG	LDD, M/W	HW/C	
Clavicorona avellanea	3	LS/OG	LDD, M/W		low to mid
Clavulina cinerea	3	LS/OG, 2G	LDD	HW/C	
Clavulina cristata	3	LS/OG, 2G	LDD	HW/C	
Clavulina ornatipes	3	LS/OG, 2G	LDD		
Clitocybe senilis	3	LS/OG	LDD, M/W		low to mid
Clitocybe subditopoda	3	LS/OG	LDD, M/W		low to mid
Collybia bakerensis	3	LS/OG	LDD		low to mid
Cordycepys capitata	3	LS/OG	LDD		
Cordycepys ophioglossoides	3	LS/OG	LDD		

Appendix Table C-3 Survey & Manage Species: Bryophytes, Fungi, Lichen, Vascular Plants

Fungi - Saprobes

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Cudonia circinans	5	LS/OG	LDD		
Cudonia monticola	3	LS/OG	LDD		
Cyphellostereum laeve	3	LS/OG	M/W		
Dichostereum granulosum	3	LS/OG	LDD		
Fayodia gracilipes (rainierensis)	3	LS/OG	LDD		low to mid
Galerina atkinsoniana	3	LS/OG	M/W		
Galerina cerina	3	LS/OG	M/W		
Galerina heterocystis	3	LS/OG	M/W		
Galerina sphagnicola	3	LS/OG	RZ, M/W		
Galerina vaittaeformis	3	LS/OG	M/W		
Gelatindoiscus flavidus	3	LS/OG			
Grandinia microsporella	5	LS/OG	LDD		
Gymnopilus puntifolius	3	LS/OG	LDD		low to mid
Gyromitra californica	3		RZ, LDD		
Gyromitra esculenta	3	2G	LDD	HW/C	
Gyromitra infula	3		LDD	HW/C	
Gyromitra melaleucoides	3		LDD		
Gyromitra montana (syn. G. gigas)	3		LDD		
Helvella compressa	3	LS/OG	RZ, M/W	HW/C	low to mid
Helvella crassitunicata	3	LS/OG	RZ, M/W		low to mid
Helvella elastica	3	LS/OG	RZ, M/W	HW/C	low to mid
Helvella maculata	3	LS/OG	RZ, M/W		low to mid
Hypomyces luteovirens	3	LS/OG	LDD		
Marasmius applanatipes	3	LS/OG	LDD		low to mid
Mycena hudsoniana	3	LS/OG	RZ, LDD	HW/C	low to mid
Mycena lilacifolia	3	LS/OG	RZ, LDD	HW/C	low to mid
Mycena marginella	3	LS/OG	RZ, LDD	HW/C	low to mid
Mycena monticola	3	LS/OG	RZ, LDD	HW/C	low to mid
Mycena overholtsii	3	LS/OG	RZ, LDD	HW/C	low to mid
Mycena quinaultensis	3	LS/OG	RZ, LDD	HW/C	low to mid
Mycena tenax	3	LS/OG	RZ, LDD	HW/C	low to mid

Appendix Table C-3 Survey & Manage Species: Bryophytes, Fungi, Lichen, Vascular Plants

Fungi - Saprobes

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Mythicomyces corneipes	3	LS/OG	LDD		low to mid
Neournula pouchetii	3	LS/OG	LDD	TSHE, THPL	
Otidea leporina	3	LS/OG	LDD, M/W	HW/C	low to mid
Otidea onotica	3	LS/OG	LDD, M/W	HW/C	low to mid
Otidea smithii	3	LS/OG	LDD, M/W		low to mid
Oxyporus nobilissimus	3	LS/OG	LDD	ABPR	
Phlebia diffusa	5	LS/OG	LDD		
Phlogoitis helevlloides	3	LS/OG	RZ, LDD		
Pholiota albivelata	3	LS/OG	RZ, LDD	HW/C	low to mid
Phytoconis ericetorum	3	LS/OG	LDD		
Pithya vulgaris	3			Abies spp.	high
Plectania latahensis	3	LS/OG	LDD		high
Plectania melastoma	1	LS/OG	LDD	HW/C	
Plectania milleri	3		LDD		high
Podostroma alutaceum	3	LS/OG	LDD		
Polyporoletus subfividus	5	LS/OG	LDD		
Postia rennyii	5	LS/OG	LDD		
Rickenella setipes	3	LS/OG	RZ, M/W		
Sarcosphaera eximia	3		D		
Scytinostroma cf. galatinum	5	LS/OG	LDD		
Sparassis crispa	3	LS/OG		PSME	low to mid
Spathularia flavida	3	LS/OG	LDD		
Stagnicola perplexa	3	LS/OG	LDD		low to mid

Lichen

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Calicium abietinum	3	LS/OG		HW/C	
Calicium adaequatum	3	LS/OG		HW/C	
Calicium adspersum	3	LS/OG		HW/C	
Calicium glaucellum	3	LS/OG		HW/C	

Appendix Table C-3 Survey & Manage Species: Bryophytes, Fungi, Lichen, Vascular Plants

Lichen

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Calicium viride	3	LS/OG		HW/C	
Cetrelia cetrarioides	3		RZ	HW/C	
Chaenotheca brunneola	3	LS/OG		HW/C	
Chaenotheca chrysocephala	3	LS/OG		HW/C	
Chaenotheca ferruginea	3	LS/OG		HW/C	
Chaenotheca furfuracea	3	LS/OG		HW/C	
Chaenotheca subroscida	3	LS/OG		HW/C	
Chaenothecopis pusilla	3	LS/OG		HW/C	
Cladonia norvegica	3	LS/OG			
Collema nigrescens	3		RZ	HW/C	
Cyphelium inquinans	3	LS/OG		HW/C	
Dendriscocaulon intricatulum	3	LS/OG	RZ, M/W	HW/C	low to mid
Dermatocarpon luridum	3	LS/OG	RZ		low to mid
Heterodermia sitchensis	4	LS/OG, 2G			
Hydrothyria venosa	3	LS/OG	RZ		low to mid
Hygomnia vittata	4	LS/OG, 2G			
Hypotrachyna revoluta	3	LS/OG			high
Leptogium burnetiae var. hirsutum	3		RZ	HW/C	
Leptogium cyanescens	3		RZ	HW/C	
Leptogium rivale	3	LS/OG	RZ, RO		low to mid
Leptogium saturninum	3		RZ, RO	HW/C	low to high
Leptogium teretiusculum	3		RZ	HW/C	low to mid
Lobaria hallii	3		RZ, M/W	HW/C	low to mid
Lobaria linita	2	LS/OG	RO		mid to high
Lobaria oregana	1	LS/OG	M/W		low to mid
Lobaria pulmonaria	1	LS/OG	M/W, RO	HW/C	low to mid
Lobaria scrobiculata	1	LS/OG	M/W, RO		low
Microcalicium arenarium	3	LS/OG		HW/C	
Mycocalicium subtile	3	LS/OG		HW/C	
Nephroma bellum	3	LS/OG	M/W, RO		low
Nephroma helveticum	2	LS/OG	M/W, RO		low

Appendix Table C-3 Survey & Manage Species: Bryophytes, Fungi, Lichen, Vascular Plants

Lichen

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Nephroma isidiosum	4	LS/OG, 2G	RO		mid
Nephroma occultum	1	LS/OG			low to mid
Nephroma parile	3	LS/OG	M/W, RO	HW/C	low
Nephroma resupinatum	1	LS/OG	M/W	HW/C	low
Pannaria leucostictoides	3	LS/OG	M/W		low
Pannaria mediterranea	3	LS/OG	M/W, RO		low
Pannaria rubiginosa	3	LS/OG			low to mid
Pannaria saubinetii	3	LS/OG	M/W, RO	HW/C	low to high
Peltigera collina	3	LS/OG	M/W, RO		low
Peltigera neckeri	3	LS/OG	LDD, M/W, RO		low
Peltigera pacifica	3	LS/OG	LDD, M/W		low
Pilophorus nigricaulis	3	LS/OG	RO		
Pseudocyphellaria anomala	2	LS/OG	M/W	HW/C	low
Pseudocyphellaria anthraspis	2	LS/OG	M/W		low
Pseudocyphellaria crocata	2	LS/OG	M/W		low
Pseudocyphellaria rainierensis	1	LS/OG			low to mid
Ramalina thrausta	3		RZ	HW/C	
Stenocybe clavata	3	LS/OG		HW/C	
Stenocybe major	3	LS/OG		HW/C	
Sticta beauvoisii	2	LS/OG	M/W		low
Sticta fuliginosa	2	LS/OG	M/W, RO	HW/C	low
Sticta limbata	2	LS/OG	M/W	HW/C	low
Thalurna dissimilis	1	LS/OG		Abies spp., PSME, TSME	high
Usnea longissima	2		RZ	HW/C	low to mid

Vascular Plants

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Allotropa virgata	1	LS/OG	LDD, D	ABAM, ABGR, PSME, TSHE, PICO	low to high
Arceuthobium tsugense	2	LS/OG		TSHE	mid to high
Botrychium minganense	2	LS/OG	RZ, M/W	THPL	mid

Appendix Table C-3 Survey & Manage Species: Bryophytes, Fungi, Lichen, Vascular Plants

Vascular Plants

Species	Rating	Seral Stage	Habitat	Trees/Genus/Species	Elevation
Botrychium montanum	1	LS/OG	LDD, M/W	THPL	mid
Coptis trifolia	3	LS/OG	RZ, LDD, M/W	Abies spp., PSME, TSHE, THPL, PIMO	low to mid
Corydalis aquae-gelidae	3		RZ		low to mid
Cypripedium montanum (west Cascades)	3	2G	M/W	HW/C	low to mid
Habenaria orbiculata	3	LS/OG	RZ, LDD, M/W	ABCO, TSHE	mid to high

Rating:1=Species present; 2=Species highly probable; 3=Species suspected; 4=Insufficient data on habitat and/or range to determine status; 5=Species not listed in Table C-3; listed in Appendix J2.
Seral Stage:LS/OG=late successional/oldgrowth; 2G=2nd growth.
Habitat:RZ=riparian zones; LDD=litter,down & duff; M/W=mesic/wet; D=dry; RO=rock outcrops,cliffs.
Trees:ABAM=Abies amabilis-Pacific silver fir; ABCO=Abies concolor-White fir; ABGR=Abies grandis-Grand fir; ABLA=Abies lasiocarpa-Subalpine fir; ABPR=Abies procera-Noble fir; HW/C=hardwoods & conifers; PICO=Pinus contorta-Lodgepole pine; PIMO=Pinus monticola-Western white pine; PSME=Pseudotsuga menziesii=Douglas-fir; THPL=Thuja plicata-Western redcedar; TSHE=Tsuga heterophylla-Western hemlock; TSME=Tsuga mertensiana-Mountain hemlock.

Special Forest Products Potential Harvest Areas in the Upper McKenzie Watershed

Species	% Coverage	Plot	Township	Range	Section
Beargrass	80.00	1225	13.00	7.00	24
Beargrass	40.00	520	13.00	7.00	28
Beargrass	65.00	1226	13.00	7.50	24
Beargrass	50.00	531	14.00	6.00	27
Beargrass	75.00	500	14.00	6.00	28
Beargrass	80.00	1224	14.00	7.00	14
Beargrass	50.00	9020	14.00	7.00	20
Beargrass	65.00	1223	14.00	7.50	11
Beargrass	50.00	1004	14.00	7.50	16
Beargrass	70.00	245	16.00	7.00	2
Beargrass	90.00	316	16.00	7.00	3
Beargrass	90.00	320	16.00	7.00	7
Beargrass	90.00	446	16.00	7.00	11
Beargrass	60.00	1036	16.00	7.00	12
Beargrass	50.00	517	16.00	7.00	12
Oregon grape	45.00	6621	14.00	6.00	36
Oregon grape	40.00	6667	14.00	7.00	31
Oregon grape	40.00	6668	14.00	7.00	31
Oregon grape	50.00	6710	15.00	6.00	1
Oregon grape	50.00	1024	15.00	6.00	16
Oregon grape	40.00	6554	15.00	6.00	25
Oregon grape	60.00	6551	15.00	6.00	26
Oregon grape	45.00	6642	15.00	6.00	36
Oregon grape	55.00	6590	15.00	7.00	6
Oregon grape	50.00	318	15.00	7.00	9
Oregon grape	75.00	6587	15.00	7.00	9
Oregon grape	45.00	6586	15.00	7.00	15
Oregon grape	40.00	1015	15.00	7.00	16
Oregon grape	50.00	6585	15.00	7.00	20
Oregon grape	40.00	1020	15.00	7.00	29
Oregon grape	65.00	6577	16.00	5.00	11
Oregon grape	60.00	248	16.00	5.00	14
Oregon grape	40.00	6131	16.00	5.00	15
Oregon grape	60.00	8314	16.00	5.00	15
Oregon grape	65.00	6144	16.00	6.00	11
Oregon grape	65.00	6641	16.00	6.00	11
Oregon grape	80.00	6569	16.00	6.00	12
Oregon grape	70.00	6608	16.00	6.00	14
Oregon grape	40.00	6142	16.00	6.00	17
Oregon grape	55.00	6591	16.00	6.00	35
Oregon grape	60.00	6716	16.00	7.00	5
Oregon grape	50.00	6627	16.00	7.00	7
Oregon grape	40.00	6713	16.00	7.00	7
Oregon grape	70.00	6611	16.00	7.00	14
Oregon grape	80.00	230	16.00	7.00	17
Oregon grape	50.00	1034	16.00	7.00	23

Special Forest Products Potential Harvest Areas in the Upper McKenzie Watershed

Species	% Coverage	Plot	Township	Range	Section
Prince's pine	25.00	6672	13.00	7.00	15
Prince's pine	20.00	8329	13.00	7.00	22
Prince's pine	45.00	6644	13.00	7.00	23
Prince's pine	40.00	1001	13.00	7.00	24
Prince's pine	30.00	522	13.00	7.00	34
Prince's pine	20.00	524	14.00	6.00	28
Prince's pine	20.00	6613	14.00	6.00	36
Prince's pine	20.00	6621	14.00	6.00	36
Prince's pine	25.00	529	14.00	7.00	7
Prince's pine	25.00	6589	14.00	7.00	29
Prince's pine	25.00	321	14.00	7.00	33
Prince's pine	45.00	6615	15.00	6.00	1
Prince's pine	25.00	6616	15.00	6.00	1
Prince's pine	40.00	447	15.00	7.00	3
Prince's pine	25.00	6588	15.00	7.00	8
Prince's pine	20.00	1236	15.00	7.00	9
Prince's pine	20.00	1235	15.00	7.00	15
Prince's pine	25.00	241	15.00	7.00	15
Prince's pine	25.00	240	15.00	7.00	21
Prince's pine	35.00	317	15.00	7.00	22
Prince's pine	40.00	1012	15.00	7.00	32
Prince's pine	20.00	1043	15.00	7.00	34
Prince's pine	20.00	1018	16.00	7.00	4
Prince's pine	30.00	8326	16.00	7.00	14
Salal	40.00	6706	15.00	6.00	11
Salal	80.00	6598	15.00	6.00	23
Salal	50.00	6553	15.00	6.00	24
Salal	40.00	6642	15.00	6.00	36
Salal	45.00	6584	15.00	7.00	17
Salal	90.00	6575	16.00	5.00	10
Salal	80.00	6578	16.00	5.00	11
Salal	90.00	6580	16.00	5.00	12
Salal	40.00	248	16.00	5.00	14
Salal	55.00	6568	16.00	6.00	11
Salal	80.00	232	16.00	6.00	12
Salal	75.00	6134	16.00	6.00	14
Salal	55.00	8316	16.00	6.00	14
Salal	85.00	6541	16.00	6.00	16
Salal	60.00	8312	16.00	6.00	16
Salal	70.00	6640	16.00	6.00	21
Salal	55.00	6542	16.00	6.00	22
Salal	70.00	6591	16.00	6.00	35
Salal	60.00	6610	16.00	7.00	19

GEOLOGY APPENDIX

AREAS OF SPECIAL GEOLOGIC INTEREST

US 126/OR 242 Intersection

Approximately three miles east of the community of McKenzie Bridge US 126 intersects Oregon 242. This intersection is near the approximate boundary of the Western and High Cascade physiographic provinces. It is also near the point at which the McKenzie River changes course direction from north-south to east-west (breaching the western escarpment of the High Cascade Graben), and at the confluence of Lost Creek and the McKenzie River.

The road cuts at this intersection were excavated through a terminal moraine placed there by a late Wisconsin glacier that moved down Lost Creek to confluence with the ice mass in the main McKenzie valley. Rounded and subrounded boulders of andesite and rhyolitic obsidian from the Middle Sister can be observed in this moraine deposit.

Lost Creek Glacial Trough

Lost Creek is so named because it and several of its tributaries disappear beneath the underlying basalt lava flows from Simms Butte and Collier cone and continue by migrating through the old stream gravel buried beneath.

During the Pleistocene, glacial ice originating near the North and Middle Sisters moved down the valley in at least three episodes (Thayer 1939) The steep walls, composed of up to 1500 feet of early High Cascade basalt flows, and the U-shaped cross section of the Lost Creek trough where it has not been affected by recent volcanism, are both characteristic of glacial valleys.

Sometime after the last glaciation 12,000 years ago, and before the Mt. Mazama eruption about 7,000 years ago, a volcanic eruption at Simms Butte produced flows of basalt lava down the Lost Creek trough in thin sheets to within a quarter of a mile of Limberlost Campground (Flahrety 1981) . A later eruption at Collier Cone, estimated to be between 500 and 2,500 years old (Taylor 1980), sent another lobe of lava into the Lost Creek trough. Flows from this cone, located at the base of North Sister, extended down the valley to approximately one-half mile beyond Lower Proxy Falls, partially covering the Simms Butte flows (Lund 1977).

Lakes

The processes that formed the lakes in the watershed include glacial scour, morainal deposits and lava damning. **Linton, and Spring Lakes** are both impounded by the Collier Cone lava flows. Neither have surface outlets They drain into the underlying porous lava.

Scott, Heart, and Hand Lake are associated with glacial scour and lava damming. Hand lake is dammed by lava from Twin Craters.

Trail Bridge, Smith and Carmen are three hydroelectric generating reservoirs. **Clear Lake and Fish Lake** were formed by lava dams during the latest eruptions of Nash and Sand Mountain Craters. **Clear Lake** is 1.5 miles long and more than 120 feet deep. It was formed about 3,000 years ago by a Sand Mountain volcanic eruption and lava flow that dammed the

McKenzie River (Bensen 1965). Rising waters inundated a standing forest which is still rooted on the lake bottom. The lake floor is light colored due to the accumulation of diatomaceous mud. Diatoms are silica-secreting fresh water plants. The lake is recharged mainly by large springs along the north and east shores which have their origin in the High Cascade plateau to the east. The porous, recent lava flows cover the previous glacial deposits and form a conduit for ground water movement. Water is also supplied from Ikenick Creek, which flows northeast into the north end of the lake.

Hackleman Creek was dammed by a lava flow from Sand Mountain approximately 3,800 years ago to form **Fish Lake** (Taylor 1968). The eastern shore of Fish Lake consists of younger basalt flows from Nash Crater. Fish Lake is normally dry during the summer due to the decreased rainfall, high porosity of the lake bottom (a major "sink-hole" exists in the lake bed, which is probably a collapsed lava tube), and a small recharge basin.

Lava Lake is located west of Little Nash Crater and was formed similarly and contemporaneously to Fish Lake and Clear Lake by a basalt flow from Nash Crater 3,800 years ago which dammed Park creek (Taylor 1968).

Lost Lake was formed, like Lava Lake, by lava flows associated with a north-south alignment of four basaltic cinder cones (Lost Lake group). The flow formed a ridge that dammed Lost Creek approximately 2,000 years ago (Taylor 1968). Big Lake is situated one mile south of Hoodoo and Hayrick Buttes and occupies a glacially scoured valley. The result of these vesicular (porous) and blocky recent High Cascade lava flows that covered previously formed drainage channels is an upper McKenzie basin that is predominantly drained underground and discharged at the surface as large springs such as **Big Spring**, on the east side of Clear Lake, **Great Spring** on the north end, and **Ice Cap Spring** near Koosah Falls.

Hot Springs, the result of deep magma chambers heating underground water and forcing it to the surface along fault lines, occur at Belknap and Deer Creek along a north-south trend following the inferred location of the Western Cascade escarpment. The Belknap Hot Springs discharge water with a temperature of 188 degrees Fahrenheit (Bowen et.al. 1978).

<u>Water Falls</u>

Linton Creek pours over a series of Husband volcanic lava flows which produced **Linton Falls**, the largest and most spectacular water fall in the Three Sisters Area. It empties into Linton Lake.

Proxy Falls is located approximately 1.5 miles west of Linton Falls. There are two main falls, Upper and Lower Proxy Falls. The two main falls are different, both in form and in origin. Water for Upper Proxy Falls originates in a large group of small springs that emerge from inner beds between lava flows about 600 feet above the valley floor. At the bottom of the falls, the water flows into a nearly circular basin from which there is no outlet. Without noticeable eddy motion or an apparent opening in the bottom of the basin, the water percolates into the lava flow and enters the subsurface drainage system (Lund 1977).

Two thick flows of basaltic andesite lava (which dammed Clear Lake) from the Sand Mountain chain of cinder cones, moved into the McKenzie River canyon 3,000 years ago. The terminus of the first flow is marked by **Koosah Falls**. **Sahalie Falls** is located atop the

terminus of the second flow 0.4 miles upstream. A series of springs can be seen across the canyon at the base of Koosah Falls, which demonstrates the subsurface drainage network of the area. As a result of the energy of the water pouring over the falls, calving of the underlying blocks of weaker rock occurs in a cycle of headword erosion, which has carved out an amphitheater into the lava margin. **Tamolitch Falls**, 2 miles downstream from Koosah Falls, was formed similarly by a volcanic eruption and lava flow from Belknap Crater 10 miles to the east, approximately 1,500 years ago (Taylor 1967).

Volcanic Cones and associated Lava Flows

The **Inaccessible Cone, Scott Mountain, and Two Butte** alignment began eruptions about 3,800 years ago on the glaciated High Cascades andesite platform. The Two Butte cinder cone is in close proximity to Hwy. 242 approximately one mile northwest of Alder Springs campground. It contains a short flow of basalt which descends the steep glaciated side of the valley for only a short distance. Scott Mtn. is a glaciated High Cascade shield volcano composed of gray, fine grained basalt capped by a small, much eroded cinder cone.

The eruptions from **Simms Butte and Collier Cone** occurred about 7,000 and 2,500 to 500 years ago, respectively, and flowed down Lost Creek Valley.

Yapoah Cone, Condon Butte, and Four-in-One Cone all erupted approximately 2,600 years ago and are part of a north-south alignment of 19 vents. The Yapoah flows poured nearly 5 miles down the eastern slope of the Cascades following the valley of a small stream. Oregon 242 follows its southern edge east of the pass, down into regions of older rocks.

Belknap, Little Belknap, South Belknap, and Twin Craters, are a focal point of nested summit cones with a long and complex episode of Holocene (recent) basalt and basaltic andesite volcanism. The broad shield of the Belknap complex is 5 miles in diameter with an estimated thickness of 1,700 feet and is 1.3 cubic miles in volume. Basaltic andesite issued from vents at the north and south bases of the cone approximately 1,500 years ago, with the exception of Little Belknap which erupted earlier at 2,900 y bp. Lava poured 12 miles to the west and ash was ejected from the northernmost of the two summit craters. The main bulk of the Belknap ash, which has been traced over an area exceeding 100 square miles, was ejected earlier from a larger south crater. Still earlier lavas were basaltic and moved eastward 7 miles from their vents.

The **Dee Wright Observatory** is located at the summit of Hwy. 242 at the McKenzie Pass. The building is constructed on a lava flow which erupted from Yapoah Cone 3 miles southeast of the highway 2,600 to 2,900 years ago and overlaps an earlier flow from the Little Belknap Crater. The observatory offers a panoramic vista of the McKenzie Lava Field and the volcanic cones which produced it.

The North Sister (elev. 10,085 feet) is a glacially dissected remnant of a large summit cone which was built upon a broad shield volcano of early High Cascade andesite. The composite cone is composed of thin flows and a central plug of uniform basaltic andesite.

The Middle Sister (elev. 10,045 feet) and South Sister (elev. 10,358) were active during the Pleistocene, and therefore were not as extensively eroded. They do not rest on shield volcanoes and are not homogeneous in composition. They contain over 26 different types of

igneous rock including rhyolites, andesites, basalts, obsidian, and tuffs. Eruptions of silicic lavas have occurred on the flanks of South Sister as recently as 2,300 to 1,900 years bp.

The **Sand Mountain Alignment** is a north-south aligned group of volcanic vents which are located from Little Nash Crater in the north to the central and south group of the Sand Mountain cones near Inaccessible Cone in the south. This alignment crosses into the Mt. Washington Wilderness, reaching a point on an imaginary east-west line that extends westward from Mt. Washington to Hwy. 126 near Beaver Marsh south of Koosah Falls. This chain of volcanoes within the area comprise a total of 22 cones with 41 distinct vents.

The lava from the Sand Mountain Alignment generally flowed westward down the slope from Nash Crater and Sand Mountain, as well as the central and south group, with an accompanying discharge of ash and cinders. These eruptions are estimated to have occurred between 3500-3800 years ago. The last massive eruption of lava came from the South Group, Nash Crater, and Little Nash Crater to constitute the earlier Clear Lake Flow, Lava Lake and Fish Lake Flows. The last Clear Lake Flow of the massive lava eruption stage which dammed the McKenzie River occurred about 3,000 years ago from the south vent of Sand Mountain (Taylor 1980).

A replica of the original Sand Mountain Lookout at the summit of Sand Mountain (elev. 5,400 feet) has recently been constructed on the site of the original lookout which was destroyed by fire several years ago. This vantage point offers one of the best views of the upper McKenzie basin to the south and west.

Taylor, (1980) describes The **Trailbridge Ignimbrite** as a distinctive Western Cascade basaltic andesite ignimbrite located in the road cut adjacent to the Trailbridge Reservoir information display and parking area. [Note: an ignimbrite is a very hot pyroclastic flow that moves in part as a mobile gas-charged lava-foam or froth with nonstratified components and various rock inclusions. Thick, porous crust develops and serves to insulate a hot, liquid interior through which inclusions settle and from which gas escapes and an intense welding process takes place.]

The outcrop is approximately 40 feet thick, cut by at least five faults, and is a very distinctive marker horizon that has been traced, without notable changes in feature, for 7 miles north and south along the Western Cascade foothills. One remarkable feature of this rock unit is the uncommon lithologies of the inclusions, which include gabbroic and dioritic porphyries. A bulk sample of the dense interior has been dated at 5 my.

Approximately 1/4 mile north of this site, on the east side of the road, across from the powerhouse, the highway cut exposes several springs emerging from an aquifer on High Cascade pillow basalt.

Mt. Washington (elev. 7,794 feet) presently is what remains of a large, symmetrical Plio-Pleistocene andesite composite cone built on top of a previously erupted shield volcano of basalt and basaltic andesite. Erosion by streams and by glaciers which etched cirques back into the peak have destroyed the superstructure of the volcano and exposed the feeding plug of intrusive rock.

Saywer's Ice Cave is lava tube formed in a flow from Crater located approximately 2 miles northeast of Fish Lake. A lava tube is formed by a slightly viscous flow that cools quickly on the outer surface, yet allows the molten lava to continue flowing, which eventually drains and leaves a hollow tube or tunnel. When the tube collapses, an entrance is formed by which access can be made. Sawyers Ice Cave has a continuous cold breeze moving through it due to the difference in air pressure from the outside and inside of the tunnel. Other areas of lava tube formation can be found east of Fish Lake in the lava field of Nash Crater.

Three Fingered Jack (elev. 7,841) to the north, like Mt. Washington and North Sister, is a heavily glaciated basaltic andesite composite cone and is estimated to be have begun erupting between 700,000 and 200,000 years ago (Davie 1980).

Maxwell Butte (elev. 6,229) is located three miles southwest of Three Fingered Jack and is considered to be a broad basaltic andesite volcano which erupted between 80,000 and 40,000 years ago. Wisconsin glaciers scoured the upper flanks but did not extend to the west base of the mountain (Davie 1980).

The Lost Lake Group of cinder cones erupted approximately 2,000 years ago and dammed lost creek to form Lost Lake. The cone north of the highway at Lost Lake directly west of the entrance to the campground is 1,000 feet wide and contains a crater 300 feet deep (Priest 1983).

Hoodoo Butte is a recent basaltic cinder cone with a summit crater that was shielded from Pleistocene glaciation by Hayrick Butte. The Butte stood as an elongate andesite dome in the path of the advancing ice.

Hogg Rock is a platy volcanic dome of very fine-grained andesite which was completely over ridden by glacial ice. Hogg rock was named for T. Egenton Hogg, who in 1888 built the grade for the Corvallis and Eastern Railroad intended to connect Newport and Boise (Taylor 1967).

Hayrick Butte is a mesa-like mass of basaltic andesite which also was overridden by the Pleistocene ice sheet (Wilson et.al. 1981).

Little Nash Crater erupted between 3,500 and 3,800 years ago and is now quarried for the red cinders that are used on the highway in the winter. The quarried areas are littered with discarded volcanic bomb fragments up to 4 feet in diameter.

Some of the prominent Western Cascade and Early High Cascade ridge-capping Basalt peaks in the western portion of the Watershed include Crescent, Echo, Squaw, Iron, Wildcat, and Carpenter Mountains, The Three Pyramids, Lookout, Browder, Bunchgrass and Smith Ridges, and Frissel Point.

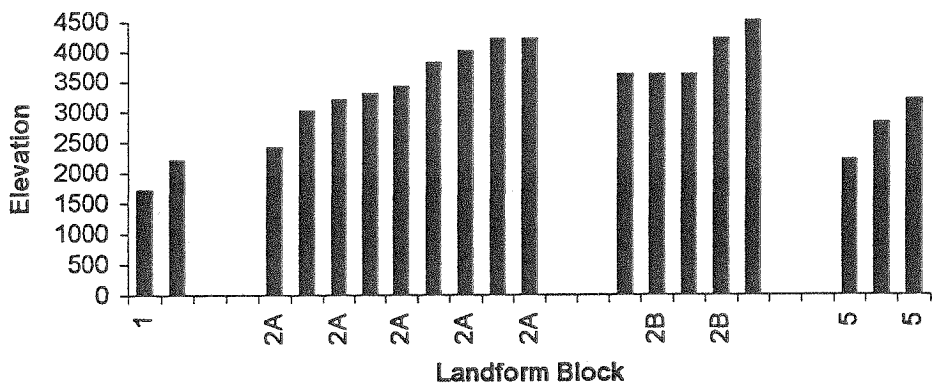
LISA ANALYSIS

The 1973 S.R.I. database for soil engineering properties was used for assigning ranges for physical variables such as soil depth, soil classification and shear strength. Slope angles were varied as intersections occurred between the S.R.I. layer, and a Slope layer which was created by bracketing slope angles into polygons < 20%, 20-50, 50-70, and >70%. These ranges of values were then entered into LISA which develops cumulative and probability distribution functions for each variable used in the infinite slope equation to calculate a factor of safety. The equation is iterated 1,000 times using a Monte Carlo simulation subroutine to randomly select variables with the ranges and distribution functions defined to solve the equation. A factor of safety frequency histogram is produced along with a Probability of Failure. This can be interpreted as a percent of area within a polygon susceptible to failure, or the relative frequency of events.

ROAD RELATED FAILURES, UPPER MCKENZIE WATERSHED

UPPER MCKENZIE WATERSHED						
Road Related Failures						
District	Road	Mile Post	S.R.I. Unit	Landform Block	Elevation	Site Informatioin
Sweet Home	2067	1	66	2B	3600	Fill slope failure, sidecast construction, 20-50 cubic yards in wet area. Alluvial deposits overlying Early High Cascades.
Sweet Home	2067	1.1	66	2B	3600	Fill slope failure, sidecast construction, 20-50 cubic yards in wet area. Alluvial deposits overlying Early High Cascades.
Sweet Home	2672425	1.2	641	2B	4500	Cut slope failure, 200-400 cubic yards, buttress constructed 1976, Western Cascades, S3C.
Sweet Home	2967510	0.6	66	2B	3600	Metal Bin Retaining Wall constructed mid 1970s. Early High Cascades.
McKenzie	2600705		16	1	1700	Slopes north of Highway 126 across from McKenzie Bridge Campground, erodable river terrace deposits and slump on landflow, concern for powerline towers, 1993, Glacial Deposits, M4
Mckenzie	2650	5.1	13	5	2800	Fill slope failure, narrow section due to loss of sidecast material, 1985, Western Cascades, M5F
McKenzie	2650	4.5	602	5	3200	Fill slope section, 125 feet of road narrow due to loss of sidecast material, 1985, Western Cascades. M6F
McKenzie	2650	5.2	602	2A	3400	Fill slope section, 75 feet of road section narrow due to loss of sidecast material, 1985, Western Cascades. M7F
McKenzie	2650	6.4	9	2A	4000	Fill slope section, 30 feet of road section narrow due to loss of sidecast material, 1985, Western Cascades, M8F
McKenzie	1500705	1.3	21/16	2A	3200	Cut slope failure in existing natural unstable slope, 1976, Western Cascades, M9C.
McKenzie	2649	0.95	16	5	2200	Cut slope failure, Buttress constructed in 1979, Western Cascades, M10F.
McKenzie	2654797	1.5	44	2A	4200	Fill failure in sidecast material, 19909, Western Cascades, M11F
Mckenzie	2654790	1.5	602/44	2A	3800	Fill failure in sidecast material, 1990, Western Cascades, M12F.
McKenzie	2633704	0.7	16	1	2200	Cut slope failure that also removed fill slope, 1990, Glacial Slope Deposits, M13C.
McKenzie	2656701	0.4	13	2A	3280	Fill slope failure, 1993, upslope of Conroy Creek earthflow, Western Cascades, M14F.
McKenzie	2655	6.5	66	2B	4200	Large fill failure, 1980, Western Cascades, M15F.
McKenzie	2655	10.2	195	2A	4200	Fill failure in saturated sidecast landing area, 1990, Western Cascades, M16F.
McKenzie	1500705	1	21	2A	3000	Fill constructed over existing slump area, continual movement, Western Cascades, M17F.
McKenzie	2655	3.8	602	2A	2400	Metal Bin Wall constructed 1984, Western Cascades.

ROAD RELATED FAILURES



GEOLOGY

APPENDIX

LEVEL I STABILITY ANALYSIS RESULTS

Level One Stability Analysis
LISA Version 2.00

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ID: SRI 3 NATURAL SLOPE

User name	MIKE LONG
Time of simulation	06-20-1995 11:43:04
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	975807309
Probability of failure	.245

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	1.00	Apex:	3.00	Max.:	4.00
Ground slope	(%)	Triangular	Min.:	60.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Uniform	Min.:	3.00	Max.:	6.00		
Root cohesion	(psf)	Histogram 5 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	30.00
2	20.00	40.00	30.00
3	40.00	60.00	20.00
4	60.00	80.00	10.00
5	80.00	100.00	10.00

Friction angle	(deg)	Uniform	Min.:	32.00	Max.:	38.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	120.00	Std.:	1.50		
Moisture content	(%)	Uniform	Min.:	10.00	Max.:	25.00		
Specific gravity		Constant	Value:	2.65				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.10	Max.:	0.30

LISA Version 2.00
SRI 3 NATURAL SLOPE

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	1.03	3.98	2.67	0.63
Ground slope	(%)	61.96	109.15	83.29	9.84
Tree surcharge	(psf)	3.00	6.00	4.52	0.86
Root cohesion	(psf)	0.05	99.53	38.19	26.36
Friction angle	(deg)	32.00	37.99	34.98	1.75
Soil cohesion	(psf)	0.01	49.98	25.75	14.33
Dry unit weight	(pcf)	115.36	124.64	119.98	1.51
Moist unit weight	(pcf)	128.85	140.00	136.38	1.79
Saturated unit wt.	(pcf)	134.23	140.00	137.10	0.94
Moisture content	(%)	10.00	24.99	17.44	4.31
Groundwater ratio	(Dw/D)	0.00	0.30	0.13	0.06
Factor of safety		0.64	2.37	1.19	0.26

Histogram of natural slope factor of safety

Range	# Values	
0.64 - 0.80	32	====
0.80 - 0.95	149	==========
0.95 - 1.11	251	==========
1.11 - 1.27	232	==========
1.27 - 1.43	176	==========
1.43 - 1.58	93	==========
1.58 - 1.74	39	=====
1.74 - 1.90	15	==
1.90 - 2.06	6	=
2.06 - 2.21	1	
2.21 - 2.37	6	=

Histogram Statistics

Number of iterations	: 1000	Sample minimum	: 0.64
Sample mean	: 1.19	Sample maximum	: 2.37
Sample median	: 1.15		
Sample standard deviation	: 0.26		
P[FS <= 1]	: 0.245		

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 3 WILDFIRE

User name	MIKE LONG
Time of simulation	06-20-1995 11:45:40
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	820389509
Probability of failure	.634

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	1.00	Apex:	3.00	Max.:	4.00
Ground slope	(%)	Triangular	Min.:	60.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Constant	Value:	0.00				
Friction angle	(deg)	Uniform	Min.:	32.00	Max.:	38.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	120.00	Std.:	1.50		
Moisture content	(%)	Uniform	Min.:	10.00	Max.:	25.00		
Specific gravity		Constant	Value:	2.65				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.10	Max.:	0.30

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	1.04	3.94	2.64	0.62
Ground slope	(%)	60.91	108.69	83.62	10.48
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.00	0.00	0.00	0.00
Friction angle	(deg)	32.00	38.00	34.92	1.72
Soil cohesion	(psf)	0.06	49.98	25.68	14.18
Dry unit weight	(pcf)	115.36	124.64	119.93	1.47
Moist unit weight	(pcf)	128.99	140.00	136.35	1.73
Saturated unit wt.	(pcf)	134.23	140.00	137.07	0.91
Moisture content	(%)	10.00	24.98	17.56	4.29
Groundwater ratio	(Dw/D)	0.00	0.29	0.13	0.06
Factor of safety		0.59	1.68	0.95	0.16

LISA Version 2.00
SRI 3 WILDFIRE

```
|-------------------------------------------------------------------------------|
|        Histogram of natural slope factor of safety                            |
|-------------------------------------------------------------------------------|
        Range          # Values
   0.59 -    0.69        25       ====
   0.69 -    0.79       115       ================
   0.79 -    0.89       244       ==========================================
   0.89 -    0.99       227       ================================
   0.99 -    1.09       188       ==========================
   1.09 -    1.18       122       ==================
   1.18 -    1.28        45       ======
   1.28 -    1.38        25       ====
   1.38 -    1.48         6       =
   1.48 -    1.58         1
   1.58 -    1.68         2
-------------------------------- Histogram Statistics ----------------------------

Number of iterations      :  1000        Sample minimum     :     0.59
Sample mean               :     0.95     Sample maximum     :     1.68
Sample median             :     0.94
Sample standard deviation:      0.16
P[ FS <= 1 ]              :     0.634
```

Level One Stability Analysis
LISA Version 2.00

ID: SRI 233/235 NATURAL SLOPE

User name	MIKE LONG
Time of simulation	06-20-1995 09:00:30
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	270694732
Probability of failure	.032

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	6.00	Apex:	10.00	Max.:	20.00
Ground slope	(%)	Triangular	Min.:	30.00	Apex:	45.00	Max.:	60.00
Tree surcharge	(psf)	Uniform	Min.:	6.00	Max.:	12.00		
Root cohesion	(psf)	Histogram 7 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	5.00
2	20.00	40.00	20.00
3	40.00	60.00	20.00
4	60.00	80.00	20.00
5	80.00	100.00	20.00
6	100.00	120.00	10.00
7	120.00	140.00	5.00

Friction angle	(deg)	Uniform	Min.:	25.00	Max.:	30.00		
Soil cohesion	(psf)	Uniform	Min.:	50.00	Max.:	250.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Uniform	Min.:	15.00	Max.:	30.00		
Specific gravity		Constant	Value:	2.4				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.10	Apex:	0.30	Max.:	0.50

LISA Version 2.00
SRI 235 NATURAL SLOPE

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	6.14	19.78	11.96	2.91
Ground slope	(%)	30.57	59.63	44.91	6.19
Tree surcharge	(psf)	6.00	12.00	9.10	1.71
Root cohesion	(psf)	0.06	139.47	65.63	31.71
Friction angle	(deg)	25.00	30.00	27.45	1.41
Soil cohesion	(psf)	50.13	249.80	148.91	57.93
Dry unit weight	(pcf)	80.36	89.64	84.94	1.45
Moist unit weight	(pcf)	93.30	113.86	103.89	4.11
Saturated unit wt.	(pcf)	109.28	114.69	111.95	0.85
Moisture content	(%)	15.01	30.00	22.30	4.28
Groundwater ratio	(Dw/D)	0.10	0.49	0.30	0.08
Factor of safety		0.81	2.42	1.46	0.29

Histogram of natural slope factor of safety

Range		# Values	
0.81 -	0.96	18	===
0.96 -	1.11	69	==========
1.11 -	1.25	154	==========
1.25 -	1.40	224	==========
1.40 -	1.54	182	==========
1.54 -	1.69	151	==========
1.69 -	1.83	89	==========
1.83 -	1.98	58	=========
1.98 -	2.13	29	=====
2.13 -	2.27	14	==
2.27 -	2.42	12	==

---------- Histogram Statistics ----------

Number of iterations	:	1000	Sample minimum	:	0.81
Sample mean	:	1.46	Sample maximum	:	2.42
Sample median	:	1.42			
Sample standard deviation	:	0.29			
P[FS <= 1]	:	0.032			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 233/235 50% CUT

User name	MIKE LONG
Time of simulation	06-20-1995 09:05:56
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	80772995
Probability of failure	.102

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	6.00	Apex:	10.00	Max.:	20.00
Ground slope	(%)	Triangular	Min.:	30.00	Apex:	45.00	Max.:	60.00
Tree surcharge	(psf)	Uniform	Min.:	3.00	Max.:	6.00		
Root cohesion	(psf)	Histogram 7 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	5.00
2	20.00	30.00	20.00
3	30.00	40.00	20.00
4	40.00	50.00	20.00
5	50.00	60.00	20.00
6	60.00	70.00	10.00
7	70.00	80.00	5.00

Friction angle	(deg)	Uniform	Min.:	25.00	Max.:	30.00		
Soil cohesion	(psf)	Uniform	Min.:	50.00	Max.:	250.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Uniform	Min.:	15.00	Max.:	30.00		
Specific gravity		Constant	Value:	2.4				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.20	Apex:	0.50	Max.:	0.70

LISA Version 2.00
SRI 235 50% CUT

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	6.21	19.71	11.86	2.91
Ground slope	(%)	30.83	59.92	44.81	6.16
Tree surcharge	(psf)	3.00	5.99	4.45	0.84
Root cohesion	(psf)	0.05	79.69	42.57	16.51
Friction angle	(deg)	25.00	30.00	27.60	1.47
Soil cohesion	(psf)	50.87	249.87	151.44	56.66
Dry unit weight	(pcf)	80.36	89.64	85.10	1.55
Moist unit weight	(pcf)	93.55	114.69	104.33	3.99
Saturated unit wt.	(pcf)	109.28	114.69	112.04	0.90
Moisture content	(%)	15.01	30.00	22.61	4.29
Groundwater ratio	(Dw/D)	0.21	0.69	0.47	0.10
Factor of safety		0.74	2.24	1.31	0.27

Histogram of natural slope factor of safety

Range		# Values	
0.74 -	0.87	29	=====
0.87 -	1.01	87	==========
1.01 -	1.15	173	==========
1.15 -	1.28	218	==========
1.28 -	1.42	192	==========
1.42 -	1.55	120	==========
1.55 -	1.69	91	==========
1.69 -	1.83	50	========
1.83 -	1.96	21	===
1.96 -	2.10	12	==
2.10 -	2.24	7	=

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.74
Sample mean	:	1.31	Sample maximum	:	2.24
Sample median	:	1.28			
Sample standard deviation	:	0.27			
P[FS <= 1]	:	0.102			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 233/235 CLEARCUT

User name	MIKE LONG
Time of simulation	06-20-1995 09:22:04
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	80772995
Probability of failure	.214

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	6.00	Apex:	10.00	Max.:	20.00
Ground slope	(%)	Triangular	Min.:	30.00	Apex:	45.00	Max.:	60.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Histogram 4 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	25.00
2	20.00	40.00	45.00
3	40.00	60.00	25.00
4	60.00	80.00	5.00

Friction angle	(deg)	Uniform	Min.:	25.00	Max.:	30.00		
Soil cohesion	(psf)	Uniform	Min.:	50.00	Max.:	250.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Uniform	Min.:	15.00	Max.:	30.00		
Specific gravity		Constant	Value:	2.4				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.30	Apex:	0.60	Max.:	0.80

LISA Version 2.00
SRI 235 CLEARCUT

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	6.21	19.71	11.86	2.91
Ground slope	(%)	30.83	59.92	44.81	6.16
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.03	79.38	31.69	17.61
Friction angle	(deg)	25.00	30.00	27.60	1.47
Soil cohesion	(psf)	50.87	249.87	151.44	56.66
Dry unit weight	(pcf)	80.36	89.64	85.10	1.55
Moist unit weight	(pcf)	93.55	114.69	104.33	3.99
Saturated unit wt.	(pcf)	109.28	114.69	112.04	0.90
Moisture content	(%)	15.01	30.00	22.61	4.29
Groundwater ratio	(Dw/D)	0.31	0.79	0.57	0.10
Factor of safety		0.67	2.12	1.21	0.25

Histogram of natural slope factor of safety

Range	# Values	
0.67 - 0.80	28	====
0.80 - 0.94	99	==========
0.94 - 1.07	176	==========
1.07 - 1.20	222	==========
1.20 - 1.33	179	==========
1.33 - 1.46	125	==========
1.46 - 1.59	89	==========
1.59 - 1.72	44	=======
1.72 - 1.85	21	===
1.85 - 1.98	11	==
1.98 - 2.12	6	=

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.67
Sample mean	:	1.21	Sample maximum	:	2.12
Sample median	:	1.19			
Sample standard deviation	:	0.25			
P[FS <= 1]	:	0.214			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 233/235 WILDFIRE

User name	MIKE LONG
Time of simulation	06-20-1995 09:16:37
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	80772995
Probability of failure	.338

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	6.00	Apex:	10.00	Max.:	20.00
Ground slope	(%)	Triangular	Min.:	30.00	Apex:	45.00	Max.:	60.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Constant	Value:	0.00				
Friction angle	(deg)	Uniform	Min.:	25.00	Max.:	30.00		
Soil cohesion	(psf)	Uniform	Min.:	50.00	Max.:	250.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Uniform	Min.:	15.00	Max.:	30.00		
Specific gravity		Constant	Value:	2.4				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.30	Apex:	0.60	Max.:	0.90

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	6.21	19.71	11.86	2.91
Ground slope	(%)	30.83	59.92	44.81	6.16
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.00	0.00	0.00	0.00
Friction angle	(deg)	25.00	30.00	27.60	1.47
Soil cohesion	(psf)	50.87	249.87	151.44	56.66
Dry unit weight	(pcf)	80.36	89.64	85.10	1.55
Moist unit weight	(pcf)	93.55	114.69	104.33	3.99
Saturated unit wt.	(pcf)	109.28	114.69	112.04	0.90
Moisture content	(%)	15.01	30.00	22.61	4.29
Groundwater ratio	(Dw/D)	0.31	0.89	0.60	0.12
Factor of safety		0.59	1.94	1.12	0.24

LISA Version 2.00
SRI 235 WILDFIRE

Histogram of natural slope factor of safety

Range		# Values	
0.59 -	0.71	18	=====
0.71 -	0.84	94	==========
0.84 -	0.96	151	==========
0.96 -	1.08	217	==========
1.08 -	1.20	195	==========
1.20 -	1.33	124	==========
1.33 -	1.45	106	==========
1.45 -	1.57	50	==========
1.57 -	1.69	24	==========
1.69 -	1.81	10	==========
1.81 -	1.94	11	==========

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.59
Sample mean	:	1.12	Sample maximum	:	1.94
Sample median	:	1.10			
Sample standard deviation	:	0.24			
P[FS <= 1]	:	0.338			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 71 NATURAL SLOPE

User name	MIKE LONG
Time of simulation	06-20-1995 12:11:10
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	269346594
Probability of failure	.057

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	1.00	Apex:	2.00	Max.:	3.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Uniform	Min.:	6.00	Max.:	12.00		
Root cohesion	(psf)	Histogram 7 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	5.00
2	20.00	40.00	20.00
3	40.00	60.00	20.00
4	60.00	80.00	20.00
5	80.00	100.00	20.00
6	100.00	120.00	10.00
7	120.00	140.00	5.00

Friction angle	(deg)	Uniform	Min.:	32.00	Max.:	38.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	120.00	Std.:	1.50		
Moisture content	(%)	Uniform	Min.:	10.00	Max.:	25.00		
Specific gravity		Constant	Value:	2.65				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.20	Max.:	0.30

LISA Version 2.00
SRI 71 NATURAL SLOPE

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	1.04	2.92	1.99	0.41
Ground slope	(%)	71.19	108.73	86.47	8.38
Tree surcharge	(psf)	6.01	11.99	9.00	1.73
Root cohesion	(psf)	0.36	139.81	66.16	31.83
Friction angle	(deg)	32.01	37.99	35.01	1.73
Soil cohesion	(psf)	0.01	49.89	24.95	14.66
Dry unit weight	(pcf)	115.48	124.64	120.03	1.46
Moist unit weight	(pcf)	127.06	140.00	136.38	1.85
Saturated unit wt.	(pcf)	134.30	140.00	137.14	0.91
Moisture content	(%)	10.01	25.00	17.48	4.32
Groundwater ratio	(Dw/D)	0.01	0.29	0.17	0.06
Factor of safety		0.63	2.80	1.47	0.34

Histogram of natural slope factor of safety

Range	# Values	
0.63 - 0.83	4	=
0.83 - 1.03	64	=========
1.03 - 1.22	192	==========
1.22 - 1.42	239	==========
1.42 - 1.62	196	==========
1.62 - 1.82	147	==========
1.82 - 2.01	88	==========
2.01 - 2.21	44	======
2.21 - 2.41	14	==
2.41 - 2.61	6	=
2.61 - 2.80	6	=

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.63
Sample mean	:	1.47	Sample maximum	:	2.80
Sample median	:	1.42			
Sample standard deviation	:	0.34			
P[FS <= 1]	:	0.057			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 71 50% CUT

User name	MIKE LONG
Time of simulation	06-20-1995 12:12:51
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	177750647
Probability of failure	.143

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	1.00	Apex:	2.00	Max.: 3.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.: 110.00
Tree surcharge	(psf)	Uniform	Min.:	3.00	Max.:	6.00	
Root cohesion	(psf)	Histogram 5 classes					

Class	Minimum	Maximum	Percent
1	0.00	20.00	20.00
2	20.00	40.00	20.00
3	40.00	60.00	30.00
4	60.00	80.00	20.00
5	80.00	100.00	10.00

Friction angle	(deg)	Uniform	Min.:	32.00	Max.:	38.00	
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00	
Dry unit weight	(pcf)	Normal	Mean:	120.00	Std.:	1.50	
Moisture content	(%)	Uniform	Min.:	10.00	Max.:	25.00	
Specific gravity		Constant	Value:	2.65			
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.20	Max.: 0.40

LISA Version 2.00
SRI 71 50% CUT

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	1.06	2.98	2.00	0.42
Ground slope	(%)	70.27	108.78	86.59	8.57
Tree surcharge	(psf)	3.00	6.00	4.49	0.88
Root cohesion	(psf)	0.21	99.91	46.07	25.26
Friction angle	(deg)	32.01	37.99	35.00	1.75
Soil cohesion	(psf)	0.06	49.97	24.53	14.45
Dry unit weight	(pcf)	115.43	124.64	119.99	1.51
Moist unit weight	(pcf)	129.74	140.00	136.34	1.81
Saturated unit wt.	(pcf)	134.27	140.00	137.11	0.94
Moisture content	(%)	10.01	24.98	17.29	4.29
Groundwater ratio	(Dw/D)	0.01	0.39	0.20	0.08
Factor of safety		0.63	2.45	1.29	0.28

Histogram of natural slope factor of safety

Range	# Values	
0.63 - 0.79	13	==
0.79 - 0.96	90	==========
0.96 - 1.12	187	==========
1.12 - 1.29	246	==========
1.29 - 1.45	216	==========
1.45 - 1.62	126	==========
1.62 - 1.78	70	==========
1.78 - 1.95	30	====
1.95 - 2.11	14	==
2.11 - 2.28	3	
2.28 - 2.45	5	=

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.63
Sample mean	:	1.29	Sample maximum	:	2.45
Sample median	:	1.27			
Sample standard deviation	:	0.28			
P[FS <= 1]	:	0.143			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 71 CLEARCUT

User name	MIKE LONG
Time of simulation	06-20-1995 12:19:11
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	826680421
Probability of failure	.239

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	1.00	Apex:	2.00	Max.:	3.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Histogram 4 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	25.00
2	20.00	40.00	45.00
3	40.00	60.00	25.00
4	60.00	80.00	5.00

Friction angle	(deg)	Uniform	Min.:	32.00	Max.:	38.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	120.00	Std.:	1.50		
Moisture content	(%)	Uniform	Min.:	10.00	Max.:	25.00		
Specific gravity		Constant	Value:	2.65				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.30	Max.:	0.40

LISA Version 2.00
SRI 71 CLEARCUT

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	1.03	2.96	2.00	0.40
Ground slope	(%)	70.53	109.37	87.05	8.62
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.07	79.18	31.93	17.83
Friction angle	(deg)	32.00	38.00	35.00	1.77
Soil cohesion	(psf)	0.05	49.90	25.04	14.43
Dry unit weight	(pcf)	115.36	124.64	120.00	1.54
Moist unit weight	(pcf)	129.16	140.00	136.40	1.83
Saturated unit wt.	(pcf)	134.23	140.00	137.12	0.96
Moisture content	(%)	10.03	24.99	17.34	4.21
Groundwater ratio	(Dw/D)	0.00	0.40	0.23	0.08
Factor of safety		0.59	2.28	1.17	0.24

Histogram of natural slope factor of safety

Range		# Values	
0.59 -	0.74	22	===
0.74 -	0.90	79	==========
0.90 -	1.05	238	==========
1.05 -	1.21	254	==========
1.21 -	1.36	222	==========
1.36 -	1.51	101	==========
1.51 -	1.67	50	=======
1.67 -	1.82	22	===
1.82 -	1.97	8	=
1.97 -	2.13	2	
2.13 -	2.28	2	

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.59
Sample mean	:	1.17	Sample maximum	:	2.28
Sample median	:	1.14			
Sample standard deviation	:	0.24			
P[FS <= 1]	:	0.239			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 71 WILDFIRE

User name	MIKE LONG
Time of simulation	06-20-1995 12:17:23
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	739197909
Probability of failure	.783

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	1.00	Apex:	2.00	Max.:	3.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Constant	Value:	0.00				
Friction angle	(deg)	Uniform	Min.:	32.00	Max.:	38.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	120.00	Std.:	1.50		
Moisture content	(%)	Uniform	Min.:	10.00	Max.:	25.00		
Specific gravity		Constant	Value:	2.65				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.40	Max.:	0.60

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	1.03	2.95	1.99	0.40
Ground slope	(%)	70.78	109.53	86.79	8.55
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.00	0.00	0.00	0.00
Friction angle	(deg)	32.00	37.99	35.00	1.70
Soil cohesion	(psf)	0.07	49.94	23.97	14.25
Dry unit weight	(pcf)	115.36	124.30	120.00	1.45
Moist unit weight	(pcf)	127.90	139.79	136.43	1.76
Saturated unit wt.	(pcf)	134.23	139.79	137.12	0.90
Moisture content	(%)	10.00	25.00	17.72	4.32
Groundwater ratio	(Dw/D)	0.01	0.59	0.33	0.12
Factor of safety		0.51	1.42	0.88	0.16

LISA Version 2.00
SRI 71 WILDFIRE

```
|-------------------------------------------------------------------------------|
|        Histogram of natural slope factor of safety                            |
|-------------------------------------------------------------------------------|
        Range          # Values
   0.51 -    0.59        14       ==
   0.59 -    0.67        79       =============
   0.67 -    0.76       130       =====================
   0.76 -    0.84       202       ================================
   0.84 -    0.92       218       ====================================
   0.92 -    1.01       152       =========================
   1.01 -    1.09       114       ==================
   1.09 -    1.17        54       =========
   1.17 -    1.26        19       ===
   1.26 -    1.34        13       ==
   1.34 -    1.42         5       =
------------------------------- Histogram Statistics ---------------------------

Number of iterations      :  1000        Sample minimum     :     0.51
Sample mean               :    0.88      Sample maximum     :     1.42
Sample median             :    0.87
Sample standard deviation:     0.16
P[ FS <= 1 ]              :    0.783
```

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 13,61,64,610,610U,614 NATURAL SLOPE

User name	MIKE LONG
Time of simulation	06-20-1995 09:58:20
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	400890052
Probability of failure	.188

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	3.00	Apex:	4.00	Max.:	6.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Uniform	Min.:	6.00	Max.:	12.00		
Root cohesion	(psf)	Histogram 7 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	5.00
2	20.00	40.00	20.00
3	40.00	60.00	20.00
4	60.00	80.00	20.00
5	80.00	100.00	20.00
6	100.00	120.00	10.00
7	120.00	140.00	5.00

Friction angle	(deg)	Uniform	Min.:	33.00	Max.:	38.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	100.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.65				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.10	Max.:	0.20

LISA Version 2.00
SRI 13,61,64,610,610U,614 NATURAL SLOPE

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	3.09	5.94	4.32	0.62
Ground slope	(%)	71.16	108.55	86.76	8.55
Tree surcharge	(psf)	6.00	11.99	9.02	1.74
Root cohesion	(psf)	0.07	139.14	65.78	31.92
Friction angle	(deg)	33.02	38.00	35.45	1.46
Soil cohesion	(psf)	0.02	49.96	24.65	14.76
Dry unit weight	(pcf)	95.90	104.64	99.95	1.50
Moist unit weight	(pcf)	103.77	117.08	109.95	2.18
Saturated unit wt.	(pcf)	122.11	127.55	124.63	0.93
Moisture content	(%)	5.37	14.64	10.00	1.50
Groundwater ratio	(Dw/D)	0.01	0.19	0.10	0.04
Factor of safety		0.63	1.80	1.17	0.19

Histogram of natural slope factor of safety

Range		# Values	
0.63 -	0.74	6	=
0.74 -	0.85	27	====
0.85 -	0.95	87	==========
0.95 -	1.06	170	==========
1.06 -	1.17	210	==========
1.17 -	1.27	213	==========
1.27 -	1.38	141	==========
1.38 -	1.48	96	==========
1.48 -	1.59	32	=====
1.59 -	1.70	12	==
1.70 -	1.80	6	=

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.63
Sample mean	:	1.17	Sample maximum	:	1.80
Sample median	:	1.17			
Sample standard deviation	:	0.19			
P[FS <= 1]	:	0.188			

Level One Stability Analysis
LISA Version 2.00

ID: SRI 13,61,64,610,610U,614 50% CUT

User name	MIKE LONG
Time of simulation	06-20-1995 11:16:02
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	359534680
Probability of failure	.248

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	3.00	Apex:	4.00	Max.:	6.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	100.00
Tree surcharge	(psf)	Uniform	Min.:	3.00	Max.:	6.00		
Root cohesion	(psf)	Histogram 6 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	20.00
2	20.00	40.00	20.00
3	40.00	60.00	30.00
4	60.00	80.00	20.00
5	80.00	100.00	10.00
6	100.00	120.00	0.00

Friction angle	(deg)	Uniform	Min.:	33.00	Max.:	38.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	100.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.65				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.10	Max.:	0.20

LISA Version 2.00
SRI 13,61,64,610,610U,614 50% CUT

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	3.04	5.97	4.30	0.62
Ground slope	(%)	70.11	98.89	83.50	6.42
Tree surcharge	(psf)	3.00	6.00	4.55	0.84
Root cohesion	(psf)	0.17	99.79	46.19	25.73
Friction angle	(deg)	33.00	38.00	35.40	1.46
Soil cohesion	(psf)	0.04	49.99	24.93	14.23
Dry unit weight	(pcf)	95.36	104.64	99.90	1.53
Moist unit weight	(pcf)	103.22	117.16	109.93	2.30
Saturated unit wt.	(pcf)	121.78	127.55	124.60	0.95
Moisture content	(%)	5.57	14.64	10.04	1.52
Groundwater ratio	(Dw/D)	0.00	0.19	0.10	0.04
Factor of safety		0.73	1.61	1.12	0.16

Histogram of natural slope factor of safety

Range	# Values	
0.73 - 0.81	16	===
0.81 - 0.89	59	==========
0.89 - 0.97	130	==========
0.97 - 1.05	172	==========
1.05 - 1.13	181	==========
1.13 - 1.21	172	==========
1.21 - 1.29	124	==========
1.29 - 1.37	79	==========
1.37 - 1.45	40	========
1.45 - 1.53	19	====
1.53 - 1.61	8	==

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.73
Sample mean	:	1.12	Sample maximum	:	1.61
Sample median	:	1.10			
Sample standard deviation	:	0.16			
P[FS <= 1]	:	0.248			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 13,61,64,610,610U,614 CLEARCUT

User name	MIKE LONG
Time of simulation	06-20-1995 11:19:47
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	496282458
Probability of failure	.5

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	3.00	Apex:	4.00	Max.:	6.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	100.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Histogram 4 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	25.00
2	20.00	40.00	45.00
3	40.00	60.00	25.00
4	60.00	80.00	5.00

Friction angle	(deg)	Uniform	Min.:	33.00	Max.:	38.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	100.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.65				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.20	Max.:	0.40

LISA Version 2.00
SRI 13,61,64,610,610U,614 CLEARCUT

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	3.03	5.93	4.35	0.63
Ground slope	(%)	70.29	99.78	83.54	6.15
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.08	78.91	31.58	17.76
Friction angle	(deg)	33.01	38.00	35.49	1.43
Soil cohesion	(psf)	0.09	49.83	25.75	14.13
Dry unit weight	(pcf)	95.43	104.64	99.98	1.50
Moist unit weight	(pcf)	102.36	116.24	110.01	2.16
Saturated unit wt.	(pcf)	121.82	127.55	124.65	0.93
Moisture content	(%)	5.37	14.64	10.03	1.50
Groundwater ratio	(Dw/D)	0.00	0.39	0.20	0.08
Factor of safety		0.68	1.43	1.01	0.13

Histogram of natural slope factor of safety

Range	# Values	
0.68 - 0.75	23	====
0.75 - 0.81	47	========
0.81 - 0.88	110	==========
0.88 - 0.95	164	==========
0.95 - 1.02	202	==========
1.02 - 1.09	183	==========
1.09 - 1.15	135	==========
1.15 - 1.22	82	==========
1.22 - 1.29	29	=====
1.29 - 1.36	20	===
1.36 - 1.43	5	=

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.68
Sample mean	:	1.01	Sample maximum	:	1.43
Sample median	:	1.00			
Sample standard deviation	:	0.13			
P[FS <= 1]	:	0.500			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 13,61,64,610,610U,614 WILDFIRE

User name	MIKE LONG
Time of simulation	06-20-1995 11:22:34
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	152340412
Probability of failure	.938

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	3.00	Apex:	4.00	Max.:	6.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	100.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Constant	Value:	0.00				
Friction angle	(deg)	Uniform	Min.:	33.00	Max.:	38.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	100.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.65				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.30	Max.:	0.60

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	3.01	5.90	4.34	0.62
Ground slope	(%)	70.63	99.13	83.34	6.12
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.00	0.00	0.00	0.00
Friction angle	(deg)	33.01	38.00	35.42	1.50
Soil cohesion	(psf)	0.01	49.98	26.31	14.60
Dry unit weight	(pcf)	95.67	104.64	99.93	1.57
Moist unit weight	(pcf)	103.41	116.64	109.84	2.31
Saturated unit wt.	(pcf)	121.97	127.55	124.62	0.98
Moisture content	(%)	5.79	14.64	9.92	1.45
Groundwater ratio	(Dw/D)	0.02	0.59	0.31	0.12
Factor of safety		0.54	1.22	0.83	0.11

LISA Version 2.00
SRI 13,61,64,610,610U,614 WILDFIRE

```
|-------------------------------------------------------------------------------|
|        Histogram of natural slope factor of safety                            |
|-------------------------------------------------------------------------------|
        Range          # Values
   0.54 -    0.60        7       =
   0.60 -    0.66       51       =======
   0.66 -    0.72      121       ================
   0.72 -    0.79      170       =======================
   0.79 -    0.85      243       ==================================
   0.85 -    0.91      186       ==========================
   0.91 -    0.97      127       ==================
   0.97 -    1.03       61       =========
   1.03 -    1.10       26       ====
   1.10 -    1.16        5       =
   1.16 -    1.22        3
------------------------------- Histogram Statistics --------------------------

Number of iterations      :  1000       Sample minimum     :     0.54
Sample mean               :    0.83     Sample maximum     :     1.22
Sample median             :    0.82
Sample standard deviation:     0.11
P[ FS <= 1 ]              :    0.938
```

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 21,31,301,310U NATURAL SLOPE

User name	MIKE LONG
Time of simulation	06-20-1995 13:03:27
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	329935789
Probability of failure	.08

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	1.00	Apex:	2.00	Max.:	3.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Uniform	Min.:	6.00	Max.:	12.00		
Root cohesion	(psf)	Histogram 7 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	5.00
2	20.00	40.00	20.00
3	40.00	60.00	20.00
4	60.00	80.00	20.00
5	80.00	100.00	20.00
6	100.00	120.00	10.00
7	120.00	140.00	5.00

Friction angle	(deg)	Uniform	Min.:	28.00	Max.:	34.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.5				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.30	Max.:	0.40

LISA Version 2.00
SRI 21,31,301,310U NATURAL SLOPE

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	1.03	2.98	1.99	0.42
Ground slope	(%)	70.44	108.34	86.38	8.37
Tree surcharge	(psf)	6.00	11.98	8.93	1.75
Root cohesion	(psf)	0.03	139.52	65.74	31.97
Friction angle	(deg)	28.00	33.99	31.04	1.73
Soil cohesion	(psf)	0.02	49.96	25.82	14.49
Dry unit weight	(pcf)	80.36	89.44	85.03	1.49
Moist unit weight	(pcf)	86.69	100.32	93.53	2.08
Saturated unit wt.	(pcf)	110.62	116.06	113.42	0.89
Moisture content	(%)	5.37	14.64	9.99	1.47
Groundwater ratio	(Dw/D)	0.01	0.40	0.23	0.09
Factor of safety		0.67	3.46	1.60	0.47

Histogram of natural slope factor of safety

Range		# Values	
0.67 -	0.92	52	========
0.92 -	1.18	141	==========
1.18 -	1.43	197	==========
1.43 -	1.69	226	==========
1.69 -	1.94	174	==========
1.94 -	2.19	99	==========
2.19 -	2.45	56	=========
2.45 -	2.70	34	=====
2.70 -	2.95	11	==
2.95 -	3.21	8	=
3.21 -	3.46	2	

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.67
Sample mean	:	1.60	Sample maximum	:	3.46
Sample median	:	1.55			
Sample standard deviation	:	0.47			
P[FS <= 1]	:	0.080			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 21,31,301,310U 50% CUT

User name	MIKE LONG
Time of simulation	06-20-1995 13:09:40
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	184953153
Probability of failure	.113

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	1.00	Apex:	2.00	Max.:	3.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Uniform	Min.:	3.00	Max.:	6.00		
Root cohesion	(psf)	Histogram 8 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	5.00
2	20.00	40.00	30.00
3	40.00	60.00	35.00
4	60.00	80.00	15.00
5	80.00	100.00	5.00
6	100.00	120.00	5.00
7	120.00	140.00	2.50
8	140.00	160.00	2.50

Friction angle	(deg)	Uniform	Min.:	28.00	Max.:	34.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.5				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.10	Apex:	0.20	Max.:	0.40

LISA Version 2.00
SRI 21,31,301,310U 50% CUT

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	1.03	2.96	1.99	0.41
Ground slope	(%)	70.75	109.41	86.92	8.49
Tree surcharge	(psf)	3.00	5.99	4.49	0.88
Root cohesion	(psf)	0.42	159.48	54.96	30.46
Friction angle	(deg)	28.01	34.00	30.87	1.68
Soil cohesion	(psf)	0.01	49.97	25.54	15.03
Dry unit weight	(pcf)	80.74	89.64	84.90	1.44
Moist unit weight	(pcf)	87.65	100.15	93.38	2.02
Saturated unit wt.	(pcf)	110.84	116.18	113.34	0.86
Moisture content	(%)	5.37	14.64	9.98	1.44
Groundwater ratio	(Dw/D)	0.10	0.40	0.23	0.06
Factor of safety		0.59	3.66	1.47	0.45

Histogram of natural slope factor of safety

Range	# Values	
0.59 - 0.87	40	=====
0.87 - 1.15	205	==========
1.15 - 1.43	295	==========
1.43 - 1.71	223	==========
1.71 - 1.99	109	==========
1.99 - 2.27	62	=======
2.27 - 2.54	41	=====
2.54 - 2.82	14	==
2.82 - 3.10	4	
3.10 - 3.38	4	
3.38 - 3.66	3	

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.59
Sample mean	:	1.47	Sample maximum	:	3.66
Sample median	:	1.39			
Sample standard deviation	:	0.45			
P[FS <= 1]	:	0.113			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 21,31,301,310U CLEARCUT

User name	MIKE LONG
Time of simulation	06-20-1995 13:11:48
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	780601382
Probability of failure	.214

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	1.00	Apex:	2.00	Max.:	3.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Histogram 4 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	5.00
2	20.00	40.00	40.00
3	40.00	60.00	45.00
4	60.00	80.00	10.00

Friction angle	(deg)	Uniform	Min.:	28.00	Max.:	34.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.5				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.10	Apex:	0.40	Max.:	0.60

LISA Version 2.00
SRI 21,31,301,310U CLEARCUT

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	1.04	2.97	2.03	0.41
Ground slope	(%)	70.43	108.28	86.28	8.28
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.09	79.71	41.85	15.75
Friction angle	(deg)	28.00	33.99	30.97	1.76
Soil cohesion	(psf)	0.01	49.96	24.54	14.75
Dry unit weight	(pcf)	80.36	89.52	84.97	1.52
Moist unit weight	(pcf)	88.06	101.37	93.49	2.07
Saturated unit wt.	(pcf)	110.62	116.11	113.38	0.91
Moisture content	(%)	5.37	13.89	10.04	1.49
Groundwater ratio	(Dw/D)	0.10	0.60	0.37	0.10
Factor of safety		0.51	2.47	1.23	0.29

Histogram of natural slope factor of safety

Range		# Values	
0.51 -	0.69	12	==
0.69 -	0.87	76	==========
0.87 -	1.05	183	==========
1.05 -	1.23	264	==========
1.23 -	1.40	211	==========
1.40 -	1.58	143	==========
1.58 -	1.76	65	=========
1.76 -	1.94	30	====
1.94 -	2.12	10	=
2.12 -	2.29	5	=
2.29 -	2.47	1	

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.51
Sample mean	:	1.23	Sample maximum	:	2.47
Sample median	:	1.20			
Sample standard deviation	:	0.29			
P[FS <= 1]	:	0.214			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 21,31,301,310U WILDFIRE

User name	MIKE LONG
Time of simulation	06-20-1995 13:04:59
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	567290604
Probability of failure	.866

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	1.00	Apex:	2.00	Max.:	3.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Constant	Value:	0.00				
Friction angle	(deg)	Uniform	Min.:	28.00	Max.:	34.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	50.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.5				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.50	Max.:	0.80

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	1.08	2.93	2.00	0.39
Ground slope	(%)	70.13	108.71	86.45	8.42
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.00	0.00	0.00	0.00
Friction angle	(deg)	28.01	34.00	31.08	1.76
Soil cohesion	(psf)	0.03	49.95	25.00	14.62
Dry unit weight	(pcf)	80.52	89.64	85.08	1.55
Moist unit weight	(pcf)	86.68	100.13	93.59	2.12
Saturated unit wt.	(pcf)	110.71	116.18	113.45	0.93
Moisture content	(%)	5.37	14.59	10.00	1.49
Groundwater ratio	(Dw/D)	0.03	0.79	0.43	0.17
Factor of safety		0.30	1.55	0.78	0.19

LISA Version 2.00
SRI 21,31,301,310U WILDFIRE

```
|-------------------------------------------------------------------------------|
|        Histogram of natural slope factor of safety                            |
|-------------------------------------------------------------------------------|
        Range        # Values
   0.30 -    0.41       6       =
   0.41 -    0.53      69       ==========
   0.53 -    0.64     182       ==============================
   0.64 -    0.75     205       ===================================
   0.75 -    0.87     213       ====================================
   0.87 -    0.98     171       ============================
   0.98 -    1.10     100       ================
   1.10 -    1.21      36       ======
   1.21 -    1.33      12       ==
   1.33 -    1.44       4       =
   1.44 -    1.55       2
------------------------------- Histogram Statistics ---------------------------

Number of iterations      :  1000       Sample minimum     :     0.30
Sample mean               :    0.78     Sample maximum     :     1.55
Sample median             :    0.77
Sample standard deviation:     0.19
P[ FS <= 1 ]              :    0.866
```

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 16 NATURAL SLOPE

User name	MIKE LONG
Time of simulation	06-20-1995 12:37:06
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	911678731
Probability of failure	.16

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	3.00	Apex:	4.00	Max.:	6.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Uniform	Min.:	6.00	Max.:	12.00		
Root cohesion	(psf)	Histogram 6 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	25.00
2	20.00	40.00	20.00
3	40.00	60.00	20.00
4	60.00	80.00	20.00
5	80.00	100.00	10.00
6	100.00	120.00	5.00

Friction angle	(deg)	Uniform	Min.:	28.00	Max.:	34.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	200.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.5				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.20	Max.:	0.30

LISA Version 2.00
SRI 16 NATURAL SLOPE

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	3.06	5.96	4.32	0.62
Ground slope	(%)	70.42	108.43	86.68	8.53
Tree surcharge	(psf)	6.01	12.00	9.08	1.70
Root cohesion	(psf)	0.02	119.26	46.73	30.52
Friction angle	(deg)	28.01	34.00	31.04	1.74
Soil cohesion	(psf)	0.03	199.94	100.81	56.88
Dry unit weight	(pcf)	80.48	89.64	85.04	1.51
Moist unit weight	(pcf)	86.74	101.95	93.59	2.08
Saturated unit wt.	(pcf)	110.69	116.18	113.42	0.90
Moisture content	(%)	5.37	14.64	10.05	1.52
Groundwater ratio	(Dw/D)	0.02	0.29	0.17	0.06
Factor of safety		0.57	2.48	1.36	0.35

Histogram of natural slope factor of safety

Range	# Values	
0.57 - 0.74	30	======
0.74 - 0.92	74	==========
0.92 - 1.09	140	==========
1.09 - 1.26	168	==========
1.26 - 1.44	185	==========
1.44 - 1.61	161	==========
1.61 - 1.79	120	==========
1.79 - 1.96	76	==========
1.96 - 2.14	29	=====
2.14 - 2.31	12	==
2.31 - 2.48	5	=

Histogram Statistics

Number of iterations	: 1000	Sample minimum	: 0.57
Sample mean	: 1.36	Sample maximum	: 2.48
Sample median	: 1.35		
Sample standard deviation	: 0.35		
P[FS <= 1]	: 0.160		

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 16 50% CUT

User name	MIKE LONG
Time of simulation	06-20-1995 12:38:40
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	106406092
Probability of failure	.224

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	3.00	Apex:	4.00	Max.:	6.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Uniform	Min.:	3.00	Max.:	6.00		
Root cohesion	(psf)	Histogram 5 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	30.00
2	20.00	40.00	35.00
3	40.00	60.00	25.00
4	60.00	80.00	5.00
5	80.00	100.00	5.00

Friction angle	(deg)	Uniform	Min.:	28.00	Max.:	34.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	200.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.5				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.20	Max.:	0.40

LISA Version 2.00
SRI 16 50% CUT

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	3.08	5.94	4.31	0.63
Ground slope	(%)	70.36	109.38	86.29	8.32
Tree surcharge	(psf)	3.00	6.00	4.54	0.89
Root cohesion	(psf)	0.02	99.94	33.89	22.63
Friction angle	(deg)	28.02	33.97	30.92	1.70
Soil cohesion	(psf)	0.76	199.96	103.76	57.32
Dry unit weight	(pcf)	80.80	88.95	84.94	1.45
Moist unit weight	(pcf)	87.34	101.15	93.37	2.10
Saturated unit wt.	(pcf)	110.88	115.77	113.36	0.87
Moisture content	(%)	5.37	14.64	9.92	1.50
Groundwater ratio	(Dw/D)	0.01	0.39	0.20	0.08
Factor of safety		0.54	2.37	1.29	0.34

Histogram of natural slope factor of safety

Range		# Values	
0.54 -	0.71	24	=====
0.71 -	0.87	98	==========
0.87 -	1.04	136	==========
1.04 -	1.20	158	==========
1.20 -	1.37	180	==========
1.37 -	1.54	172	==========
1.54 -	1.70	111	==========
1.70 -	1.87	62	==========
1.87 -	2.03	40	========
2.03 -	2.20	11	==
2.20 -	2.37	8	==

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.54
Sample mean	:	1.29	Sample maximum	:	2.37
Sample median	:	1.28			
Sample standard deviation	:	0.34			
P[FS <= 1]	:	0.224			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 16 CLEARCUT

User name	MIKE LONG
Time of simulation	06-20-1995 12:40:39
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	286323130
Probability of failure	.321

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	3.00	Apex:	4.00	Max.:	6.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Histogram 3 classes						

Class	Minimum	Maximum	Percent
1	0.00	20.00	40.00
2	20.00	40.00	50.00
3	40.00	60.00	10.00

Friction angle	(deg)	Uniform	Min.:	28.00	Max.:	34.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	200.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.5				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.30	Max.:	0.50

LISA Version 2.00
SRI 16 CLEARCUT

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	3.02	5.92	4.36	0.64
Ground slope	(%)	70.61	108.64	86.59	8.39
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.08	59.84	24.22	14.16
Friction angle	(deg)	28.00	34.00	30.91	1.71
Soil cohesion	(psf)	0.09	199.95	101.36	58.42
Dry unit weight	(pcf)	80.36	89.64	84.92	1.46
Moist unit weight	(pcf)	86.38	99.68	93.41	2.03
Saturated unit wt.	(pcf)	110.62	116.18	113.35	0.88
Moisture content	(%)	5.47	14.64	10.00	1.52
Groundwater ratio	(Dw/D)	0.02	0.50	0.27	0.10
Factor of safety		0.44	2.16	1.19	0.32

Histogram of natural slope factor of safety

Range	# Values	
0.44 - 0.59	12	===
0.59 - 0.75	63	==========
0.75 - 0.91	156	==========
0.91 - 1.06	154	==========
1.06 - 1.22	156	==========
1.22 - 1.38	164	==========
1.38 - 1.53	138	==========
1.53 - 1.69	89	==========
1.69 - 1.85	48	==========
1.85 - 2.00	14	===
2.00 - 2.16	6	=

Histogram Statistics

Number of iterations	:	1000	Sample minimum	:	0.44
Sample mean	:	1.19	Sample maximum	:	2.16
Sample median	:	1.18			
Sample standard deviation	:	0.32			
P[FS <= 1]	:	0.321			

Level One Stability Analysis
LISA Version 2.00

==========

ID: SRI 16 WILDFIRE

User name	MIKE LONG
Time of simulation	06-20-1995 12:41:54
Map unit	LB1.MPU
Number of iterations	1000
Random number seed	610829830
Probability of failure	.486

INPUT DATA

NATURAL DATA

Soil depth	(ft)	Triangular	Min.:	3.00	Apex:	4.00	Max.:	6.00
Ground slope	(%)	Triangular	Min.:	70.00	Apex:	80.00	Max.:	110.00
Tree surcharge	(psf)	Constant	Value:	0.00				
Root cohesion	(psf)	Constant	Value:	0.00				
Friction angle	(deg)	Uniform	Min.:	28.00	Max.:	34.00		
Soil cohesion	(psf)	Uniform	Min.:	0.00	Max.:	200.00		
Dry unit weight	(pcf)	Normal	Mean:	85.00	Std.:	1.50		
Moisture content	(%)	Normal	Mean:	10.00	Std.:	1.50		
Specific gravity		Constant	Value:	2.5				
Groundwater ratio	(Dw/D)	Triangular	Min.:	0.00	Apex:	0.40	Max.:	0.70

DESCRIPTIVE STATISTICS OF SIMULATED VALUES -- NATURAL SLOPE

		MINIMUM	MAXIMUM	MEAN	S.D.
Soil depth	(ft)	3.03	5.89	4.34	0.63
Ground slope	(%)	70.40	109.42	86.51	8.27
Tree surcharge	(psf)	0.00	0.00	0.00	0.00
Root cohesion	(psf)	0.00	0.00	0.00	0.00
Friction angle	(deg)	28.00	34.00	30.95	1.77
Soil cohesion	(psf)	0.02	199.94	101.49	57.61
Dry unit weight	(pcf)	80.36	89.64	84.97	1.53
Moist unit weight	(pcf)	87.24	99.22	93.46	2.07
Saturated unit wt.	(pcf)	110.62	116.18	113.38	0.92
Moisture content	(%)	5.50	14.64	9.99	1.48
Groundwater ratio	(Dw/D)	0.01	0.69	0.36	0.14
Factor of safety		0.41	1.97	1.03	0.31

LISA Version 2.00
SRI 16 WILDFIRE

Histogram of natural slope factor of safety

Range		# Values	
0.41 -	0.55	41	=========
0.55 -	0.69	122	==========
0.69 -	0.83	142	==========
0.83 -	0.98	151	==========
0.98 -	1.12	154	==========
1.12 -	1.26	158	==========
1.26 -	1.40	106	==========
1.40 -	1.54	71	==========
1.54 -	1.68	35	========
1.68 -	1.83	16	====
1.83 -	1.97	4	=

Histogram Statistics

Number of iterations	: 1000	Sample minimum	: 0.41
Sample mean	: 1.03	Sample maximum	: 1.97
Sample median	: 1.01		
Sample standard deviation	: 0.31		
P[FS <= 1]	: 0.486		

FISHERIES APPENDIX

Methods for determining risk of extinction of bull trout populations and assumptions.

As described in Chapter 3, the McKenzie population, due to its isolation, is difficult to describe using current models to assess population viability (Rieman and McIntyre 1993). A description of risk based on Nehlsen et al. (1991) and further developed by Ratliff and Howell (1992) is used to describe bull trout population risk based upon the following criteria: relative abundance, habitat condition, presence of brook trout, and recovery potential (Table 1).

Table 1. Bull trout risk of extinction criteria

Category	Abundance	Habitat	Brook trout	Recovery potential
Low risk of extinction	High	Excellent	None	
Of special concern	↕	↕	↕	Very good
Moderate risk of extinction				↕
High risk of extinction	Very low	Poor	High	Major effort required
Probably extinct	No reports since 1980			

table from Ratliff and Howell 1992.

The McKenzie population was rated by Ratliff and Howell in 1992 as at moderate risk of extinction due to the following suppressing factors:

- Abundance low - over harvest (recent game regulations permitted keeping bull trout) and low known population.
- Habitat fair - habitat degradation due to the effects of timber harvest/riparian development and fragmentation of habitat with passage barriers.
- Brook trout present in low numbers - brook trout have established themselves in the upper McKenzie presenting competition and hybridization risks.

There presently has not been a significant change in these conditions. Recent increases in adult populations observed in redd counts in the fall of 1994 are likely due to recent changes in game regulations and inventory of spawning habitat not previously surveyed. Although encouraging, such fluctuations are characteristic of a small population. Upgrading the McKenzie population status should rely on long term improvement in spawning populations and reduction of other suppressing factors. A summer 1995 project will provide passage around a barrier culvert in Olallie Creek. About one mile of historically accessible spawning and rearing habitat will be available

in Olallie Creek. Rearing habitat has been identified as a factor limiting bull trout production in the upper McKenzie River. Bull trout fry have been reintroduced into upper Olallie Creek for the past two years (1994-95) in anticipation of reestablishing access. Bull trout reintroduction is scheduled to continue through 1998.

The Trail Bridge population, artificially isolated above Trail Bridge Dam, was rated by Ratliff and Howell in 1992 as at high risk of extinction due to the following suppressing factors:

- Abundance extremely low - over harvest (recent game regulations permitted keeping bull trout) and low known population.
- Habitat fair - habitat alteration due to construction of dam/timber harvest/riparian development and fragmentation of habitat with passage barriers.
- Brook trout present in high numbers - brook trout have established themselves in the Trail Bridge pool presenting competition and hybridization risks.

Although the population remains at high risk of extinction, the outlook is hopeful. Recent treatment of a barrier to Sweetwater Creek spawning and rearing habitat in 1992 and reseeding efforts (1993-95) are expected to reestablish bull trout use of this spring-fed tributary to Trail Bridge pool. Bull trout reintroduction is scheduled to continue through 1998. Monitoring of the Trail Bridge population continues and will allow up to date population status.

Evaluation of existing and historic aquatic habitat and channel condition and assumptions.

To assess aquatic habitat condition, several methods of physical habitat inventory have been referred to in this analysis. Region 6 of the Forest Service uses a methodology, the Stream Inventory Handbook (USFS Level II Method), that has evolved since 1988 into its most recent iteration, Version 7.5, 1994. Earlier Level II surveys include the Gifford Pinchot Method (USFS G-P Method) which used similar units to measure physical habitat such as large wood and channel measurements. The Forest Service protocols measure habitat in feet. A similar, metric based protocol is used by Oregon Department of Fish and Wildlife. Large wood and channel dimensions are easily converted to the Forest Service format. Surveys conducted since 1990 are most recent in the analysis area and were used to represent current aquatic habitat condition.

Several habitat parameters have been singled out to reflect channel and aquatic habitat condition. The processes of channel morphology are significantly influenced by in-stream large wood in the Cascades, their presence deflecting flows to shape channel complexity, form pools, and provide cover and nutrients, elements important to species at risk adapted to this landscape and described in this analysis. Large pool frequency is partially a function of active channel width, channel gradient and substrate, and in the Cascades the frequency of pools often correlate to the presence or absence of large in-stream wood. The influence of land management activities is often evident in stream survey summaries as low quantities of in-stream wood, low pool frequency, and/or low pool depth.

A difference in recording large pools between the ODFW and USFS methods exists. The ODFW protocol records all pools, including pocket pool habitat in its total of pool habitat. The Forest Service method records channel spanning pool habitats (as long as they are wide) as large pools for a pool habitat total. For this reason, direct comparison of pool habitat area is not possible between the two methods.

Valley Segment Types and Geographical Information System (GIS) analysis of historic and existing seral stage are another method of assessing riparian influence and associated channel condition. Flood plain width, available shade and stream temperature, recruitment supply of future in-stream wood, and riparian seral stage were examined for historic and current condition.

Quantitative parameters representing naturally functioning channels have been developed for western Cascades streams by researchers at the Forest Service Lab, Pacific Northwest Research Station (PNW), the Regional Ecological Assessment Report (REAP) and other sources and provide insight for historic channel condition when none is available in managed landscapes. A "least managed" landscape and stream in a landform block also provides historic insight. The following table summarizes reference conditions used to evaluate existing aquatic habitat and channel condition

(Table 9). These conditions were used when information was not available to estimate historic conditon.

table to be provided at a later date

Stream classifications:

Class I streams are perennial (year round flow) or intermittent (flowing part of the year) streams that meet one or more of the following criteria: 1) serve as the direct source of water for domestic use; 2) provide habitats for either spawning, rearing, or migration of large numbers of fish: and/or 3) contain sufficient flow to have a major influence on water quality of another Class I stream.

Class II streams are perennial or intermittent streams that meet one or both of the following characteristics: 1) provide habitats for either spawning, rearing, or migration for moderate though significant numbers of fish: and/or 2) contain sufficient flow to have a moderated influence on water quality of a downstream Class I or II stream. Fish are present for at least a portion of the year or the stream has the potential for establishment or re-establishment of fish populations.

Class III streams are all other perennial streams that do not meet the criteria for Class I or II streams

Class IV streams are all other intermittent or ephemeral streams that do not meet the criteria for Class I, II or II streams (USDA Forest Service, 1990).

WILDLIFE APPENDIX

SPOTTED OWLS

ACRES OF SUITABLE HABITAT FOR SPOTTED OWLS WITHIN THE UPPER McKENZIE WATERSHED.

Site Name	Acres 1.2*	Site Name	Acres 1.2*	Site Name	Acres 1..2*
Anderson Creek	1547	Frissell Creek	1861	Norwegian Creek	2110
Belknap Springs	2044	Frissell Point	1646	Payne Spring	2058
Boulder Creek	1802	Great Spgs/Clear Lk	1285	Potato Hill	1466
Budworm Creek	1804	Hand Lake Trail	1241	Powers Creek	1176
Bunchgrass Creek	1803	Irish Camp Lake	383	Proxy Point	1492
Bunchgrass Mountain	1482	Kuitan Lake	1323	Santiam Junction	1194
Carpenter Creek	1651	Lost Branch	1696	Smith Reservoir	2014
County Creek	1670	Lost Creek	1914	South Station	1002
Carmen Reservoir	1339	Lost Lake	1143	Sweet Water Creek	1950
Deer Creek	1771	Lower Browder Creek	2281	Tamolitch Falls	1812
East Beaver Marsh	1399	L. Bunchgrass Ridge	1575	Upper Kink Creek	894
East Boulder Creek	1441	Lower Foley Ridge	1681	West County	1447
Fish Lake	1095	McKenzie Gulch	1677	West Scott	0994
Florence Creek	1092	Nash Crater	950	White Branch	1602
				Wild Cat RNA	2896

* 1.2 = mile radius from owl site center

ACRES OF SUITABLE HABITAT FOR SPOTTED OWL SITES OUTSIDE THE UPPER McKENZIE WATERSHED THAT HAVE HOME RANGES EXTENDING INTO THE WATERSHED.

Site Name	Acres 1.2*	Site Name	Acres 1.2*	Site Name	Acres 1..2*
Cone Peak	887	Lookout Mountain	1802	South Pyramid	1932
East Mill Creek	1275	Maude Creek	1278	South Station	1002
East Wildcat Mtn	1860	N. Browder Creek	1835	Tombstone Summit	1675
Echo Cr/Lost Prairie	1537	N. Carpenter Mtn	1202	Upper Crescent Cr	1805
Indian Creek	1651	Parks Creek	1863	Upper Foley Ridge	2281
Indian Creek/Tombstone	1673	Parks Lava	1268	Upper Gate Creek	1880
Lake Creek	1497	Silver Lake	1545	Upper Separation	2139
Lava Lake	1466	Smith River	2054	Upper Smith River	1869

* 1.2 = mile radius from owl site center

SUMMARY OF THE CURRENT CONDITION OF THE SANTIAM PASS CRITICAL HABITAT UNIT 15

Capable acres are those areas that are capable of producing stands of spotted owl nesting, roosting, foraging, or dispersal habitat that are not currently in one of these habitat conditions.

		NRFD		CAP		NEV CAP	
CHU #	TOTAL ACRES	AC	%	AC	%	AC	%
15	42919	24668	57	12135	28	6116	14

KEY TO CHU TABLE:

TOTAL AC.: TOTAL ACRES OF NFRD HABITAT PLUS CAPABLE HABITAT ON FEDERAL LAND IN CHU

NRFD AC., %: TOTAL BASELINE ACRES OF NRFD HABITAT IN CHU, AND % OF TOTAL ACRES

CAP. AC., %: TOTAL BASELINE ACRES, NOT CURRENTLY NRFD HABITAT, THAT ARE CAPABLE OF PRODUCING NRFD HABITAT IN THE FUTURE, AND % OF TOTAL ACRES.

NEV CAP, AC,%: TOTAL ACRES THAT WILL NEVER BE CAPABLE OF PRODUCING NRFD HABITAT

EXISTING DATA FOR CHU 15 OWL SITES.

CHU#	STS.KN +	STS.KN -	STS.EX +	TOT
15	9	6	1	16

KEY TO TABLE CHU 15 OWL SITES:
STS.KN+: PAIRS AND RESIDENT SINGLES DETECTED WITHIN THE LAST 3 YEARS; AT OR ABOVE THE USFWS PROPOSED TAKE THRESHOLD IN THE APPROPRIATE PROVINCE.

STS.KN-: SITES DETECTED WITHIN THE LAST 3 YEARS; THAT DO NOT MEET THRESHOLD.

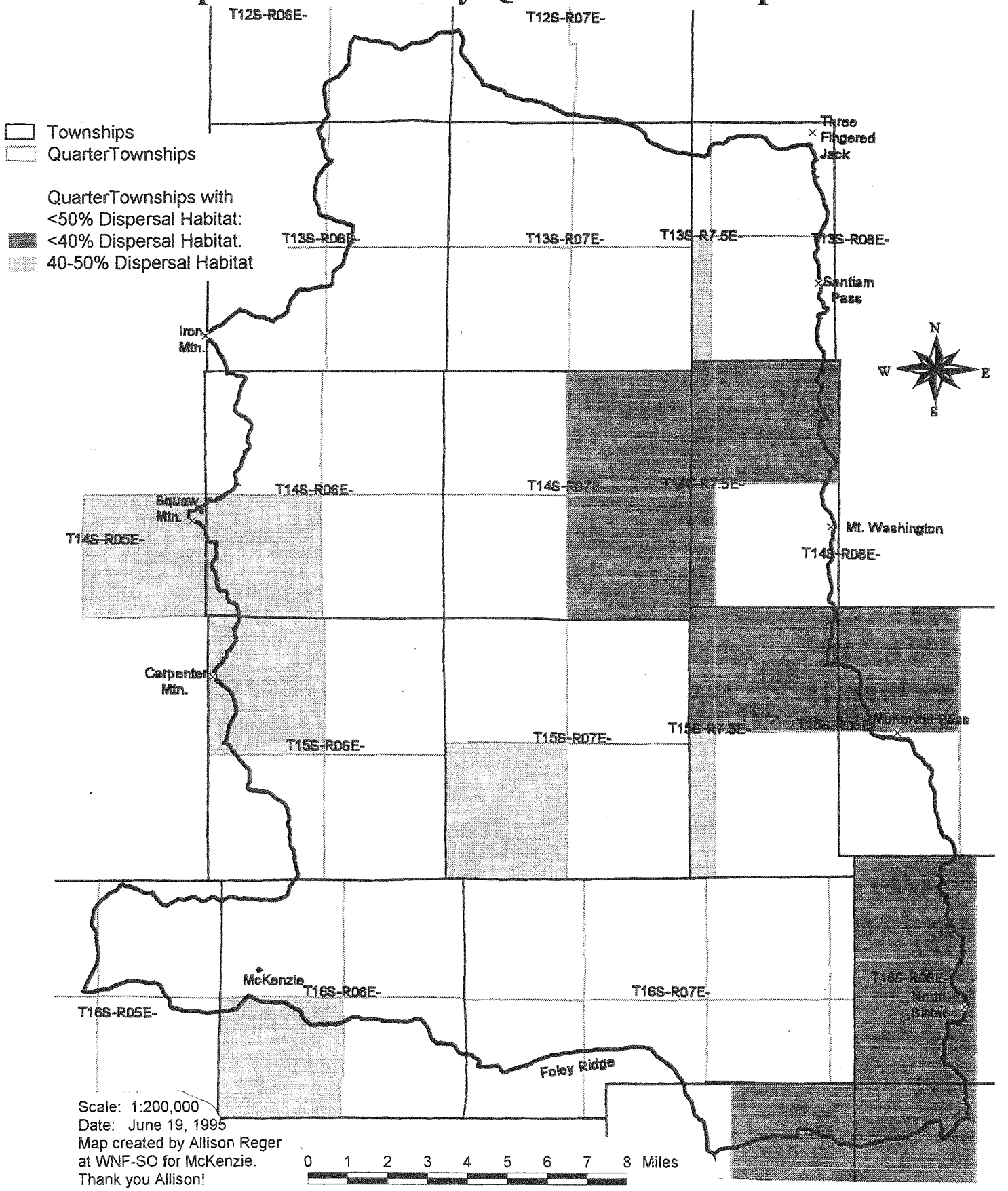
STS.EX.+ SITES EXPECTED TO BE OCCUPIED, BUT NOT ADEQUATELY SURVEYED WITHIN THE LAST 3 YEARS. MAY BE COUNTED IF HABITAT MEETS THRESHOLD.

TOT.: TOTAL OF FIRST 3 COLUMNS.

50-11-40 ANALYSIS FOR QUARTER TOWNSHIPS IN THE UPPER McKENZIE WATERSHED

	LSRs and wilderness included			
	Total	Capable	Dispersal Habitat	
Quarter Township	Acres	Acres	Ac	%
T.12S R.6E SE	5,624	4,805	3,110	64.7%
T.12S R.6E SW	5,579	4,607	3,501	76.0%
T.12S R.7 1/2E SE	5,451	4,768	3,588	75.3%
T.12S R.7 1/2E SW	873	827	670	81.0%
T.13S R.6E NE	5,837	4,178	2,103	50.3%
T.13S R.6E NW	5,574	3,647	2,238	61.4%
T.13S R.6E SE	5,702	5,271	2,750	52.2%
T.13S R.6E SW	5,538	3,603	2,747	76.2%
T.13S R.7 1/2E NE	4,614	3,570	2,466	69.1%
T.13S R.7 1/2E NW	814	572	397	69.4%
T.13S R.7 1/2E SE	5,079	4,619	2,877	62.3%
T.13S R.7 1/2E SW	932	768	347	45.1%
T.13S R.7E NE	5,628	5,145	4,368	84.9%
T.13S R.7E NW	5,802	4,914	2,746	55.9%
T.13S R.7E SE	5,736	5,601	3,514	62.7%
T.13S R.7E SW	5,784	4,956	2,741	55.3%
T.14S R.5E SE	5,675	3,858	2,018	52.3%
T.14S R.6E NE	5,755	5,475	3,646	66.6%
T.14S R.6E NW	5,447	4,872	2,832	58.1%
T.14S R.6E SE	5,750	5,545	4,090	73.8%
T.14S R.6E SW	5,334	5,020	2,424	48.3%
T.14S R.7 1/2E NE	4,965	4,658	2,999	64.4%
T.14S R.7 1/2E NW	1,121	1,114	572	51.3%
T.14S R.7 1/2E SE	5,314	3,657	2,981	81.5%
T.14S R.7 1/2E SW	1,161	781	661	84.6%
T.14S R.7E NE	5,895	5,735	2,050	35.8%
T.14S R.7E NW	5,760	5,462	3,217	58.9%
T.14S R.7E SE	5,824	4,218	2,068	49.0%
T.14S R.7E SW	5,804	5,330	3,063	57.5%
T.15S R.6E NE	6,170	5,938	3,845	64.8%
T.15S R.6E NW	6,086	5,784	2,965	51.3%
T.15S R.6E SE	5,790	5,596	3,436	61.4%
T.15S R.6E SW	5,532	5,091	3,819	75.0%
T.15S R.7 1/2E NE	5,584	1,509	345	22.8%
T.15S R.7 1/2E NW	1,234	1,080	466	43.1%
T.15S R.7 1/2E SE	6,874	4,513	3,427	75.9%
T.15S R.7 1/2E SW	1,423	1,411	566	40.1%

Dispersal Habitat by QuarterTownship



	LSRs and wilderness included			
	Total	Capable	Dispersal Habitat	
Quarter Township	Acres	Acres	Ac	%
T.15S R.7E NE	5,760	5,634	3,932	69.8%
T.15S R.7E NW	5,765	5,755	3,084	53.6%
T.15S R.7E SE	6,246	6,112	5,230	85.6%
T.15S R.7E SW	6,272	6,270	2,623	41.8%
T.15S R.8E NW	629	53	15	28.1%
T.15S R.8E SW	4,350	1,703	1,099	64.5%
T.16S R.5E NE	5,425	4,209	3,108	73.8%
T.16S R.5E NW	5,688	4,398	2,233	50.8%
T.16S R.5E SE	5,553	3,758	3,218	85.6%
T.16S R.6E NE	5,399	4,590	2,885	62.8%
T.16S R.6E NW	5,429	3,885	2,502	64.4%
T.16S R.6E SE	5,659	5,485	3,855	70.3%
T.16S R.6E SW	5,697	5,064	3,710	73.3%
T.16S R.7E NE	6,776	6,229	4,559	73.2%
T.16S R.7E NW	11,148	10,749	6,930	64.5%
T.16S R.7E SE	4,983	4,563	4,146	90.9%
T.16S R.7E SW	9,187	8,406	5,624	66.9%
T.16S R.8E NW	3,831	940	767	81.6%
T.16S R.8E SW	4,801	504	371	73.6%
T.17S R.7E NE	5,757	4,409	3,089	70.1%
T.17S R.7E NW	5,907	5,799	4,038	69.6%
T.17S R.8E NW	5,510	1,108	663	59.8%

See following map for location of quarter townships.

ANALYSIS OF LATE SUCCESSIONAL RESERVES

There are five Late Successional Reserves less than 10 miles from the Santiam Forest Health EIS project area. Their approximate distance is displayed in the following table.

DIRECTION AND DISTANCE TO LATE SUCCESSIONAL RESERVES WITHIN 10 MILES OF THE PLANNING AREA.

Direction	Distance to LSR
North	7 miles (RO214)
Northwest	0 (RO213)
West	0 (RO215)
East (2)	1 (RO244,RO245)
South	0 (RO218)

The following tables give detailed information on each LSR less than 10 miles from the project area. The data tables attempt to assess the "health" of each LSR in terms of detected spotted owl sites; owl sites within a take situation; and reproductive history.

Please realize that survey intensities have varied greatly within the LSR's, The majority of the areas have not received consistent survey coverage on a regular basis. We do not have information on percent surveyed at this time.

SUMMARY OF LSR R0213

Total Acres for LSR RO213 = 84198
Percent of NRF habitat = 62
Total existing number of sites (Pairs/Resident singles) = 48
Potential owl sites = 22*
Number of Pairs/RS in a Take Situation = 9

*based on an assumption that 80% of the LSR could be NRF habitat at any one time, and each owl pair's home range is 3000 acres.

This LSR lies to the northwest of the analysis area. Over 50% of its landbase is currently in a NRF condition. It contains 48 owl sites, which twice the calculated potential. Nine owl sites are in a "take" situation.

SUMMARY LSR R0214

Total acres = 40035
Percent of NFR = 52
Number of owl sites (Pairs/resident singles) = 25
Potential owl sites = 11*
Number of owl Pairs/Rs in a Take situation = 14

*based on an assumption that 80% of the LSR could be in an NRF condition at any one time, and each owl pair's home range is 3000 acres.

This LSR lies to the north of the analysis area on the Detroit Ranger District. Over 50% of its landbase is currently in a NRF condition. It contains 25 owl sites, which is over twice the calculated potential. However, over half of the existing sites are in a take situation.

SUMMARY OF LSR R0215

Total acres = 26514
Percent of NFR = 76
Number of owl sites (Pairs/Resident singles) = 14
Potential owl sites = 7*
Number of owl Pairs/Rs in a Take situation = 1

*based on an assumption that 80% of the LSR could be in an NRF condition at any one time, and each owl pair's home range is 3000 acres.

This LSR lies to the west of the analysis area on the Sweet Home Ranger District. Over 50% of its landbase is currently in a NRF condition. It contains 14 owl sites, which is twice the calculated potential. Only one of the existing sites is in a take situation.

SUMMARY OF LSR RO218

Total Acres = 26366
Percent of NRF habitat = 70
Total existing number of sites (Pairs/Resident singles) = 16
Potential owl sites = 7*
Number of Pairs/RS in a Take Situation = 1

* based on an assumption that 80% of the LSR could be NRF habitat at any one time, and each owl pair's home range is 3000 acres.

This LSR lies to the south of the analysis area. Over 50% of its landbase is currently in a NRF condition. It contains 16 owl sites, which is twice the calculated potential. One owl site is in a "take" situation.

SUMMARY OF LSR R0244

Total acres = 28572
Percent of NFR = 33
Number of owl sites (Pairs/resident singles) = 5
Potential Owl sites = 8*
Number of owl Pairs/RS in a Take situation = 5

*based on an assumption that 80% of the LSR could be in an NRF condition at any one time, and each owl pair's home range is 3000 acres.

This LSR lies to the east of the analysis area on the Deschutes National Forest. Less than 50% of its landbase is currently in a NRF condition as defined by west side definitions. This habitat is comprised of ponderosa pine and true firs. The LSR contains 5 owl sites, which is less than the calculated potential. All of the existing sites are in a take situation as defined by westside rules. In reality, less than 80% of the LSR may be capable of producing NRF habitat of signficant quality because of the vegetation conditions.

SUMMARY OF LSR R0245

Total acres = 75762
Percent of NFR = 34
Number of owl sites (Pairs/resident singles) = 14
Potential owl sites = 20
Number of owl Pairs/RS in a Take situation = 14

*based on an assumption that 80% of the LSR could be in an NRF condition at any one time, and each owl pair's home range is 3000 acres.

This LSR lies to the east of the analysis area on the Deschutes National Forest. Less than 50% of its landbase is currently in a NRF condition as defined by west side definitions. This habitat is comprised of ponderosa pine and true firs. The LSR contains 14 owl sites, which is less than the calculated potential. All of the existing sites are in a take situation as defined by westside rules. In reality, less than 80% of the LSR may be capable of producing NRF habitat of signficant quality because of the vegetation conditions.

BIG GAME ANALYSIS

HABITAT EFFECTIVENESS RATINGS FOR THE UPPER McKENZIE WATERSHED SUBDRAINAGES

Habitat effectiveness ratings for size and spacing of forage and cover areas (HEs), forage quality (HEf), cover quality (HEc), open road density (HEr), and overall habitat effectiveness (HEsrcf). ( ) indicates analysis on winter range portion only. (*) indicates no winter range or not enough acres of winter range to effect analysis.

HIGH EMPHASIS

HE VALUE	KINK	ANDERSON OLLALIE	NORWEGIAN TWISTY	BOULDER	SCOTT
HEs	0.70	0.71	0.83	0.68	0.87
HEc	0.40 (0.46)	0.49 (0.49)	0.46 (0.46)	0.44 (0.41	0.45 (0.44)
HEf	0.37	0.43	0.36	0.34	0.33
HEr	0.54	0.58	0.54	0.68	0.51
HEsrcf	0.48	0.54	0.52	0.51	0.507

HE VALUE	HACKLE-MAN	GATE/ IKENICK	UW McK. FRITZ BUNCH-GRASS	FLORENCE MILL	MAUDE
HEs	0.88	0.85	0.82	0.71	0.84
HEc	0.51 (0.44)	0.66 (0.64)	0.47 (0.47)	0.50 (0.49	0.59 (*)
HEf	0.28	0.39	0.42	0.33	0.37
HEr	0.48	0.54	0.49	0.41	0.43
HEsrcf	0.49	0.586	0.53	0.468	0.53

HE VALUE	BROW-DER	N. FORK PARKS
HEs	0.85	0.91
HEc	0.63 (0.66)	0.57 (*)
HEf	0.45	0.39
HEr	0.50	0.47
HEsrcf	0.59	0.56

MODERATE EMPHASIS

HE VALUE	OLD SQUAW W. BRUSH E. BRUSH	MID DEER CARPENTER COUNTY	BUDWORM FRISSELL	UPPER NORTH SANTIAM	PARADISE BELKNAP
HEs	0.83	0.90	0.86	0.78	0.52
HEc	0.40	0.41	0.52	0.46	0.45
HEf	0.52	0.48	0.39	0.27	0.45
HEr	0.38	0.48	0.53	0.74	0.54
Hesrcf	0.51	0.51	0.55	0.52	0.488

HE VALUE	S. SIDE McKENZIE	N. SIDE HORSE	FROST	HOODOO	WHITE BRANCH
HEs	0.66	0.62	0.53	0.55	0.37
HEc	0.53	0.43	0.57	0.21	0.34
HEf	0.46	0.40	0.28	0.49	0.61
HEr	0.40	0.46	0.57	0.40	0.63
HEsrcf	0.50	0.47	0.47	0.39	0.47

LOW EMPHASIS

HE VALUE	E. SIDE UPPER McKENZIE	WASHING-TON	CRATERS
HEs	0.63	0.55	0.20
HEc	0.36	0.20	0.25
HEf	0.27	0.67	0.00
HEr	0.54	1.00	0.74
HEsrcf	0.43	0.52	0.00

HE VALUES CALCULATED WITHOUT PRIVATE ACRES (FOREST SERVICE ACRES ONLY)

HIGH EMPHASIS

HE VALUE	MAUDE	N. FORK PARKS	HACKLEMAN	FLORENCE MILL
HEs	0.80	0.90	0.87	0.65
HEc	0.69 (*)	0.61 (*)	0.52 (0.44)	0.51 (0.50)
HEf	0.39	0.43	0.28	0.38
HEr	0.45	0.52	0.48	0.43
HEsrcf	0.56	0.59	0.50	0.48

MODERATE EMPHASIS

HE VALUE	FROST
HEs	0.70
HEc	0.58
HEf	0.32
HEr	0.54
HEsrcf	0.51

SNAG ANALYSIS

SNAG REQUIREMENTS FOR MANAGING SNAG GUILD IN COMPLIANCE WITH THE 1994 ROD.

Low elevation in the UPPER McKENZIE WATERSHED includes western hemlock and
Douglas-fir series. High elevation includes Mountain hemlock, Pacific silver fir, and grand fir.

CAVITY USING SPECIES	100% LEVELS LOW ELEVATION	100% LEVELS HIGH ELEVATION
RED.BREASTED SAPSUCKER	0.45	.45
DOWNY WP	0.16	NP
HAIRY WP	1.92	1.92□
RED.BREASTED NUTHATCH	0.76	0.76
WHITE.BREASTED NUTHATCH	NP	0.76
N.FLICKER	0.48	0.48
PILEATED WP	0.06	0.06
BLACK-CAPPED CHICKADEE	2NDARY	2NDARY
WILLIAMSON'S SAPSUCKER	NP	0.33
THREE -TOED WP	NP	0.06
BLACK BACKED WP	NP	ADDED SEPARATELY
MOUNTAIN CHICKADEE	2NDARY	2NDARY
CHESTNUT-BACKED WP	2NDARY	2NDARY
LEWIS WP	NO BREEDING RECORDS	NP
ACORN WP	NO BREEDING RECORDS	NP
WHITE-HEADED WP	NO BREEDING RECORDS	NP
TOTAL	-3.83	4.82

SNAGS TO MEET LOW ELEVATION 40% REQUIREMENT:

.4 X 3.83 = -1.532

SNAGS TO MEET HIGH ELEVATION 40% REQUIREMENT + 100% BLACK BACKED REQUIREMENT:

.4 X 4.82 = 1.928 + .12 FOR BLACK BACKED = -2.048-□

WILDLIFE SPECIES THAT USE SNAGS FOR BREEDING IN EARLY SERAL HABITAT BY VEGETION SERIES

VEG SERIES	# SPECIES THAT PRIMARILY USE EARLY SERAL FOR BREEDING	# SPECIES REQUIRING SNAGS	# SPECIES REQUIRING DOWN WOODY MATERIAL
GRAND FIR	125	36	45
PACIFIC SILVER FIR	103	33	41
WESTERN HEMLOCK	114	32	45
DOUGLAS FIR	120	32	49
MT HEMLOCK	106	34	40

24% OR 78 SPECIES OF WILDLIFE ON THE WILLAMETTE NF REQUIRE SNAGS IN EARLY, MID OR LATE SERAL FORESTED HABITAT FOR BREEDING.

21% OR 68 SPECIES OF WILDLIFE ON THE WILLAMETTE NF REQUIRE DOWN WOODY MATERIAL IN EARLY, MID OR LATE SERAL FORESTED HABITAT FOR BREEDING.

PERCENT SNAG HABITAT LEVELS BY LANDFORM BLOCK

LANDFORM BLOCK	SNAG LEVEL
1	46
2A	49
2B	53
3	48
4	55
5	52
6	66

ASSUMPTIONS:

LATE SUCCESSIONAL HABITAT PROVIDING 80% LEVELS. Reduced from 100% for roadside salvage and younger stands in this class that may not have developed large snags yet.
MID SUCCESSIONAL HABITAT PROVIDING 30-40% LEVELS. Reduced from 100% for roadside salvage and younger stands that have not developed snags of larger size yet.
EARLY SUCCESSIONAL HABITAT PROVIDING 40% LEVELS ON 5-10% OF THE ACRES AND 0% ON 90-95% OF THE ACRES. Reduced since only been implementing Forest Plan standard for 40% retention for past 4 years. All early seral prior to that has no snag retention.